FINAL
LANDFILL MONITORING AND MAINTENANCE PLAN
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
ORIGINAL LANDFILL

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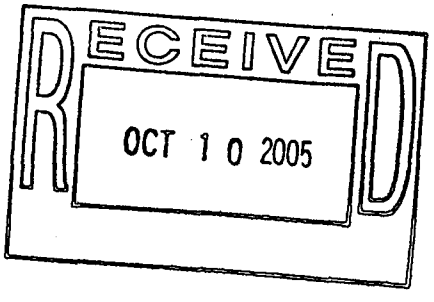

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LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DQO	data quality objective
EPA	Environmental Protection Agency
H	horizontal
IDW	investigation-derived waste
IM/IRA	Interim Measure/Interim Remedial Action
IMP	Integrated Monitoring Plan
Kaiser-Hill	Kaiser-Hill Company L.L.C.
LHSU	lower hydrostratigraphic unit
ml	milliliter
mph	miles per hour
OLF	Original Landfill
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RL	reporting limit
SOP	Standard Operating Procedure
UHSU	upper hydrostratigraphic unit
V	vertical
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 PURPOSE

This Monitoring and Maintenance Plan (Plan) has been prepared for the Original Landfill (Individual Hazardous Substance Site 115) at the Rocky Flats Environmental Technology Site (RFETS) and is designed to meet the following objectives:

1. Describe the procedures to be used to maintain the integrity and effectiveness of the final cover, including making repairs as necessary (Section 3.0);
2. Describe the features necessary to maintain and monitor the groundwater monitoring system (Section 4.0); and
3. Describe the features necessary to prevent run-on and runoff from eroding or otherwise damaging the final cover (Section 5.0).

Under the Final Interim Measure/Interim Remedial Action (IM/IRA) for the Original Landfill (Kaiser-Hill Company L.L.C. [Kaiser-Hill] 2005), a 2-foot-thick soil cover was selected to address closure of the Original Landfill. To enhance the slope stability of the landfill, the existing slopes were regraded prior to placement of the soil cover, and a buttress fill was installed at the toe of the landfill. The remedial action also included installation of perimeter drainage channels and cover diversion berms to control surface water run-on and runoff around the landfill cover. Construction was completed in September 2005, with the final regulatory walk-down occurring on September 12, 2005.

1.2 FACILITY LOCATION AND UNITS

RFETS is a government-owned facility formerly used for the fabrication of miscellaneous weapons components for national defense. The 6,550-acre site is located in Jefferson County, Colorado, approximately 16 miles northwest of Denver (Figure 1-1). The Original Landfill is located south of the RFETS Industrial Area on a south-facing hill slope north of Woman Creek (Figure 1-2).

1.3 SITE OPERATIONS

The Original Landfill was used to dispose of solid sanitary and construction debris wastes generated at the Rocky Flats Plant from 1952 to 1968 (Rockwell 1988). The landfill was not

designed or operated as an engineered landfill. Aerial photographs indicate that the landfill was operated as an area fill (EG&G 1994). Waste was merely dumped in the area vertically below and just south of the southern edge of the alluvial pediment on which the RFETS Industrial Area is located. The waste disposal area lies north of Woman Creek. The waste was generally spread over the south-facing hillside, serving to fill in the area below the pediment edge. No liner or other collection barrier was installed between the waste and the existing surfaces (Kaiser-Hill 2005). Additional information can be found in the IM/IRA for the Original Landfill (Kaiser-Hill 2005).

2.0 SITE PHYSICAL DESCRIPTION

This section describes the physical conditions at the Original Landfill site, such as topography, hydrology, climate and precipitation, hydrogeology, and site features, which include the final cover, the buttress fill, the stormwater management system, the Resource Conservation and Recovery Act (RCRA) groundwater monitoring network, and the surface water monitoring locations.

2.1 TOPOGRAPHY

The final topography of the Original Landfill is as shown on the post-construction survey (Figure 2-1). Slopes are as follows:

- Soil cover slope – 18 percent.
- Top of buttress fill slope – 2-5 percent.
- Buttress fill (south) sideslope – 3 horizontal (H):1 vertical (V)
- Perimeter channel sideslope – generally 3H:1V
- Perimeter channel slopes – approximately 12 percent

2.2 HYDROLOGY

The Original Landfill is located within the Woman Creek drainage. Diversion berms have been constructed on the soil cover to minimize surface water overland flow and divert run-on and run-off to the perimeter channels. The perimeter channels divert the surface water south of the landfill to below the buttress fill. Below the buttress fill, the perimeter channel slopes decrease, and flow encounters rock outfalls that dissipate the flow energy and allow the surface water to return to overland or sheet flow between the buttress fill and Woman Creek.

2.3 CLIMATE AND PRECIPITATION

RFETS is located in the southern Rocky Mountains and has a continental, semiarid climate. The region is noted for large seasonal temperature variations, occasional dramatic short-term temperature changes, and strong, gusty winds that reach 75 miles per hour (mph). Mean annual precipitation is approximately 15.5 inches, with approximately one-half of that amount occurring as snow.

2.4 HYDROGEOLOGY

In the area of the Original Landfill, groundwater flows predominantly within the upper hydrostratigraphic unit (UHSU). The UHSU is composed of materials that include the quaternary Rocky Flats Alluvium, colluvium, Valley Fill Alluvium, and weathered claystone bedrock. Unweathered bedrock claystones are included as part of the lower hydrostratigraphic unit (LHSU). Groundwater elevations typically vary seasonally less than 5 feet, mostly in response to direct precipitation recharge in wetter periods and evapotranspiration in warmer months. Water levels above the weathered bedrock range from 0 to 5 feet along Woman Creek; below the bedrock in the east-central waste area; 5 to 10 feet in the central waste area; 0 to 5 feet in the western waste area; and from 10 to more than 40 feet above the bedrock north of the Original Landfill (Kaiser-Hill 2005).

Natural groundwater seeps were discovered during construction of the soil cover and perimeter channels. Several seeps were mitigated with a subsurface drain to the buttress sub-drain. The buttress sub-drain was constructed beneath the buttress fill to prevent buttress saturation. This drainage layer directs water to the south of the buttress into the Valley Fill Alluvium.

2.5 SITE FEATURES

Site features included in the monitoring program at the Original Landfill include the final cover, the buttress fill, the stormwater management system, the RCRA groundwater monitoring network, and the surface water sampling locations. Construction included regrading of the site to consistent slopes. This included regrading the waste and placement of clean imported soil gradefill material. A minimum of 2-feet of Rocky Flats Alluvium soil cover was placed within the limit of waste. Monitoring procedures are provided in subsequent sections.

2.5.1 Final Cover

The final cover of the Original Landfill includes a 2-foot-thick Rocky Flats Alluvium soil cover that was constructed over both the regraded surface and the buttress fill. The 2-foot-thick soil cover was constructed within the limit of waste and does not extend to the perimeter channels. Surface soil between the limit of waste and the perimeter channels is also Rocky Flats Alluvium, but was placed as regrade material.

Inspection and monitoring procedures to maintain the integrity and effectiveness of the final cover are included in Section 3.0.

2.5.2 Buttress Fill

The buttress fill is an approximately 20-foot-high, 1,000-foot-long soil mass placed at the toe of the landfill (Figure 2-1). The compacted soil for the buttress fill was continuously tested for compaction and moisture content to meet design specifications. A sub-drain lies beneath the buttress fill and consists of drainage rock covered with a geotextile separation layer. The sub-drain is located below the surface and cannot be visually inspected. The buttress fill was constructed over the sub-drain with engineered fill compacted in 1-foot lifts.

2.5.3 Stormwater Management System

2.5.3.1 Introduction

The stormwater management plan is presented in Appendix D of the Original Landfill Design Submittal (Earth Tech, Inc. 2005). This appendix presents the results of calculations used to determine the stormwater run-on and runoff volumes to adequately design the diversion berms and perimeter channels. The stormwater management structures are designed to the 100-year, 24-hour storm event and include capacity to handle a 1,000-year, 24-hour storm event.

2.5.3.2 Applications

Effective stormwater management is achieved in the system by applying the following principles:

- Protect the land surface from erosion (Section 2.5.3.3),
- Manage run-on and runoff (Section 2.5.3.4), and
- Inspect and maintain the erosion and stormwater management practices (discussed in Section 3.0).

In the long term, the system is designed as an erosion control system so sediment control will not be necessary since limited sediment will be generated. In the short term, sediment will be controlled with temporary erosion lining and check dams (GeoRidge®).

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2.5.3.3 Erosion Control

At the Original Landfill, stormwater management features have been designed with erosion control features to limit both short-term erosion and long-term erosion. Erosion control is any practice that protects soil surfaces and prevents the soil particles from being detached by rainfall or wind. Following construction, the soil cover was covered with both straw mulch and a spray-on erosion control medium called Flexterra™. The diversion berms and upper slope portions of the buttress fill are lined with temporary erosion mat. The diversion berms included temporary check dams (GeoRidge®) to limit sediment transport. These measures will limit short-term erosion until vegetation is established. The check dams may be removed at the end of the 2006 growing season if the vegetation is well established. The perimeter channels and lower sideslope of the buttress are lined with permanent erosion mat. Rock outfalls are present at the diversion berm outfalls to the perimeter channel outfalls to prevent scouring. All areas have been seeded to aid in long-term erosion protection.

2.5.3.4 Run-on and Runoff Control

The stormwater management system is designed to collect, route, and discharge storm water run-on and runoff. Run-on stormwater is conveyed from upper portions of the Original Landfill as overland flow and then enters either the diversion berms or perimeter channels. Runoff enters the perimeter channel from overland flow on the cover and from the diversion berms constructed on the cover.

2.5.4 RCRA Groundwater Monitoring Network

Four RCRA monitoring wells will be used for groundwater monitoring at the Original Landfill as discussed in Section 4.0. These wells will be monitored in accordance with the RFETS Integrated Monitoring Plan (IMP), FY2005 (Rocky Flats 2005). Of the four wells, one is upgradient and three are downgradient of the Original Landfill.

2.5.5 Surface Water Monitoring

Surface water monitoring will be conducted at two locations, one upgradient and one downgradient of the Original Landfill. Sampling locations and procedures are discussed in Section 4.0.

During construction, intermittent seeps were discovered and remedied if necessary. Seep inspection is required and is discussed in Section 3.3.

3.0 FINAL COVER AND STORMWATER MANAGEMENT SYSTEM INSPECTION AND MONITORING

This section outlines the inspection and monitoring program to be undertaken at the Original Landfill to ensure that the integrity of the cover is not compromised and continues to function as designed. Inspection and monitoring tasks will include monitoring subsidence/consolidation, slope stability, soil cover, vegetation, and stormwater management structures so that any potential maintenance actions can be taken in a timely manner.

3.1 INSPECTION PROCEDURES

In accordance with the IM/IRA (Kaiser-Hill 2005), site inspections of the area will be conducted on a quarterly basis following construction of the final cover, with the following exceptions:

- The site shall be inspected within two days after a storm event of one inch or more of rain in a 24-hour period,
- The site shall be inspected within two days after significant melt of a 10-inch or more snow storm assuming 10 inches of snow is equivalent to one inch of water, and
- The vegetation shall be inspected on a monthly basis from April to September and quarterly the rest of the year for the first two growing seasons following initial seeding (2006 and 2007).

Quarterly inspections will continue for five years and will be evaluated at the first Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review.

Site inspections will be performed using a prescribed form containing a checklist of items that documents the evaluation of site conditions. The inspection form is included in Appendix A. The findings and observations of the site inspection will be entered on the form and presented in an Annual Original Landfill Monitoring Report. If deficiencies are discovered that require immediate attention, the Rocky Flats Cleanup Agreement (RFCA) parties will be notified.

3.2 SUBSIDENCE / CONSOLIDATION

Subsidence and consolidation at the Original Landfill largely depend on how well the waste was compacted when placed, thickness of the waste, age, and waste composition. Waste subsidence or continued consolidation may result in differential settlement, which generally occurs when

one area of waste settles more readily than another because of differences in waste composition, compaction, thickness, and moisture content. Differential settlement across the landfill may create cracks on the surface, which would allow precipitation to infiltrate more easily. Differential settlement can also change the topography of the landfill and create areas on the surface where ponding of water can occur. Localized waste subsidence can manifest itself in the form of cracks, depressions, and sinkholes. Construction of the final cover system included placement of engineered fills. Therefore, cover subsidence or consolidation is less of a concern than is waste subsidence.

3.2.1 Monitoring Locations and Procedures

Subsidence/consolidation at the Original Landfill will be monitored by visually inspecting the entire surface of the landfill cover for cracks, depressions, and sinkholes on a quarterly basis. Visual inspections will involve traversing the landfill to gain perspective on regions of the landfill, i.e., every square foot of the landfill is not traversed. In addition, the seven diversion berm flow lines will be traversed to look for sloughing or differential settling that could change the flow line slope or berm height.

3.2.2 Maintenance Action Activities

If differential settlement or localized subsidence appears to be substantial and likely to influence the integrity of the existing cover and surface water drainage over the Original Landfill, the RFCA parties will be consulted and maintenance actions may be taken to mitigate these concerns (e.g. areas of ponding water on the cover). Maintenance actions may include, but not be limited to, regrading the affected area to eliminate ponding and/or correct the slope of the surface. A maintenance action plan will be prepared, and the RFCA parties will be consulted prior to any action.

3.3 SLOPE STABILITY

A landfill site may be susceptible to instability due to lateral movement. Slope failures can be caused by the weight of the wastes and cover material, steeply regraded slopes, and seepage forces resulting from water infiltration. Seismic forces can also cause slope failures. Steep slopes produce less stable conditions and are more susceptible to failure. Slope failures can also occur within the waste mass, resulting in downslope sliding of the cover components. The cover

system with buttress fill has been designed and constructed with applicable safety factors to guard against slope failure. Nevertheless, slope stability will be monitored.

3.3.1 Monitoring Locations and Procedures

Slope stability at the Original Landfill will be monitored by visually inspecting the cover, the perimeter channel sideslopes, and the buttress fill sideslope slope for signs of cracks, evidence of block failure, seeps, and evidence of rotational failure. Visual inspection will involve traversing the slope to gain a perspective of the entire slope.

3.3.2 Maintenance Action Activities

Based on the site monitoring data and consultation with RFCA parties, maintenance actions may be taken to address any potential slope stability failure at the site. The maintenance actions will include, but not be limited to, regrading affected areas, filling areas, maintaining positive drainage of surface water, seep drain construction, and regrading steep sections to achieve side slopes no greater than 4H:1V. A maintenance action plan will be prepared, and the RFCA parties will be consulted prior to any action.

3.4 SOIL COVER

The cover system at the Original Landfill is designed to meet the minimum soil erosion requirements from both water and wind erosion. During the post-closure period, it is important to ensure that both temporary and permanent erosion controls are functioning properly. Regardless, the soil cover thickness may change over time due to wind and water erosion. Subsidence due to waste settlement and lateral movement of wastes or slopes may also contribute to changes in differential soil cover thickness.

3.4.1 Monitoring Locations and Procedures

Monitoring of the soil cover at the Original Landfill will include the following:

- Visually inspecting the soil cover for erosion or deposition areas on a quarterly basis; and
- Visually inspecting the soil cover for signs of burrowing animals on a quarterly basis.

Visual inspection will involve traversing the slope to gain a perspective of the entire area.

3.4.2 Maintenance Action Activities

If monitoring indicates significant loss of soil over time, the RFCA parties will be consulted and maintenance actions may be taken. Maintenance action will include, but not be limited to additional soil placement and regrading the affected areas to maintain the minimum design soil cover thickness and removing and relocating eroded soils (if necessary). The regraded areas will be vegetated per design criteria to prevent further erosion. Erosion control measures may be implemented to prevent further erosion of cover soils, (e.g., erosion control mat, revegetation), if necessary. A maintenance action plan will be prepared, and the RFCA parties will be consulted prior to any action.

3.5 VEGETATION

Vegetation is important to long-term erosion protection for the cover, the upper portion of the buttress sideslope, and the diversion berms. Permanent erosion mat has been placed in the perimeter channels and the lower portion of the buttress sideslope; nevertheless, vegetation is important to reinforcing the erosion mat and providing long-term protection. For short-term protection, Flexterra and crimped straw have been placed on the cover, and temporary erosion mat, which has a 2 to 3 year life span, has been placed on the diversion berms and upper buttress fill sideslope. In addition, check dams have been placed in the diversion berms. Vegetation inspections will ensure that vegetation is established properly.

3.5.1 Monitoring Locations and Procedures

The vegetation at the Original Landfill will be monitored by visual inspection on a monthly basis from April to September and quarterly for the rest of the year for the first two growing seasons following initial seeding (2006 and 2007), and only quarterly after that. Monthly inspections will help identify problematic weeds that can grow quickly and potential drought conditions that can adversely affect young vegetation. The vegetation will be monitored by traversing the cover and visually inspecting for the health of the grasses and for unwanted vegetation such as weeds or deep-rooting trees. The percentage of weeds versus grass on the cover will be estimated. At least one of the inspections during the spring/summer months must be conducted by a competent person capable of identifying weed species known in the area. If, after the first growing season, the Flexterra and mulch have eroded and vegetation is sparse, maintenance action will be necessary on the cover. If, after two growing seasons, the temporary erosion mat in the diversion

berms and upper buttress fill sideslope has degraded and vegetation is sparse, maintenance action will also be necessary.

3.5.2 Maintenance Action Activities

If visual inspections indicate vegetation concerns on the cover, the RFCA parties will be consulted and maintenance actions may be taken. Actions may include, but not be limited to the following:

- Localized reseeding of the soil cover,
- Spot herbicide applications,
- Reseeding,
- Reapplication of temporary erosion controls,
- Removal of deep-rooting trees and repair of the area, and
- Planting willows in wet (seep) areas.

A maintenance action plan will be prepared, and the RFCA parties will be consulted prior to any action.

3.6 STORMWATER MANAGEMENT STRUCTURES

Stormwater management inspections will be required on a quarterly basis at the Original Landfill to ensure that existing stormwater control structures (man-made drainage features) are functioning adequately to achieve the following objectives:

- Reduce flow onto the landfill (run-on controls),
- Reduce overland flow on the landfill,
- Collection and transport of runoff from the Original Landfill, and
- Limit transport of sediment from the disturbed areas to off-site drainage ways.

Existing stormwater controls at the Original Landfill include the following (Figure 2-1):

- Diversion berms 1 through 7,
- Diversion berm outfalls 1 through 7,
- Diversion berm temporary check dams (GeoRidge®),
- West perimeter channel,
- East perimeter channel,

- West perimeter channel outfall,
- East perimeter channel outfall,
- Permanent erosion mat-lined lower buttress fill sideslope,
- Vegetation/temporary erosion mat-lined upper buttress fill sideslope, and
- Temporary, naturally degradable, straw waddles between the diversion berms for additional erosion control.

Details of each type of structure are included on Figure 3-1.

3.6.1 Monitoring Locations and Procedures

Stormwater management structures will be monitored visually by walking the structures and examining all components. Problem areas will be noted on the inspection form, graphically depicted, and photographed. At a minimum, these structures will be inspected for signs of excessive erosion, settlement, bank failure, breaches in the diversion berms, subsidence, burrowing animals, and blockage. Signs of potential problems include, but are not limited to, ponding water, gullying, sediment build-up, and depressions.

The perimeter channel lining and temporary diversion berm lining will be inspected for evidence of damage, displacement, undermining, scour, or deterioration. Repairs shall be made to re-stabilize the channel in accordance with the design specifications. Permanent and temporary erosion control mat lining on the buttress fill sideslope will also be inspected. The erosion control mat will be inspected for holes, rips, and separation. In addition, any evidence of erosion rills or gullies will be monitored during the inspection. The temporary check dams placed perpendicular to the flow lines of the berms will be inspected for excessive sediment and removed after vegetation is established. Riprap in the diversion berm and perimeter channel outfalls will be inspected for integrity and excessive sediment.

3.6.2 Maintenance Action Activities

If the inspections indicate that the existing stormwater management structures are not adequately controlling surface water run-on and runoff, RFCA parties will be consulted and maintenance actions may be taken.

Routine maintenance of the surface water controls may include removing any blockages, filling eroded areas, replacing erosion control mat, or repairing other disturbances as necessary. Sediment may be removed periodically from the stormwater management structures to restore the design characteristics of the structure. Areas that exhibit excessive erosion may require placement of erosion control material or strengthening of the existing erosion control measures. A maintenance action plan will be prepared, and the RFCA parties will be consulted prior to any action.

3.6.3 Institutional Controls

Institutional controls are used to control access and restrict activities at the Original Landfill to ensure the effectiveness of the engineered controls and the monitoring systems. Inspection at the Present Landfill will look for evidence that violate the institutional controls or damage the physical controls. On a quarterly basis, an inspection will be conducted to look for evidence of the following activities:

- Excavation(s) of the cover and in the immediate vicinity of the cover,
- Construction of roads, trails or buildings on the cover,
- Drilling of wells or use of groundwater for any purpose other than the accelerated action,
- Disruption or damage of the seep treatment system, and
- Damage or removal of any signage or groundwater monitoring wells at the Original Landfill.

A checklist of these items is included on the inspection form found in Appendix A.

3.6.4 Condition of Monitoring Points

All established monitoring locations, such as groundwater wells, will be evaluated for ongoing integrity. The inspection will include documentation of any damage to the monitoring points that would impact their usefulness for inspections.

3.6.5 Site Conditions

During site inspections, signs, markers, and the overall condition of the Original Landfill site will be checked to determine continuing effectiveness of institutional and physical controls.

3.6.6 Reporting and Record Keeping

Inspection reports and findings will be included in the Annual Original Landfill Monitoring Reports discussed in Section 6.0. These annual reports will be submitted to the EPA and the Colorado Department of Public Health and Environment (CDPHE).

4.0 GROUNDWATER MONITORING PLAN

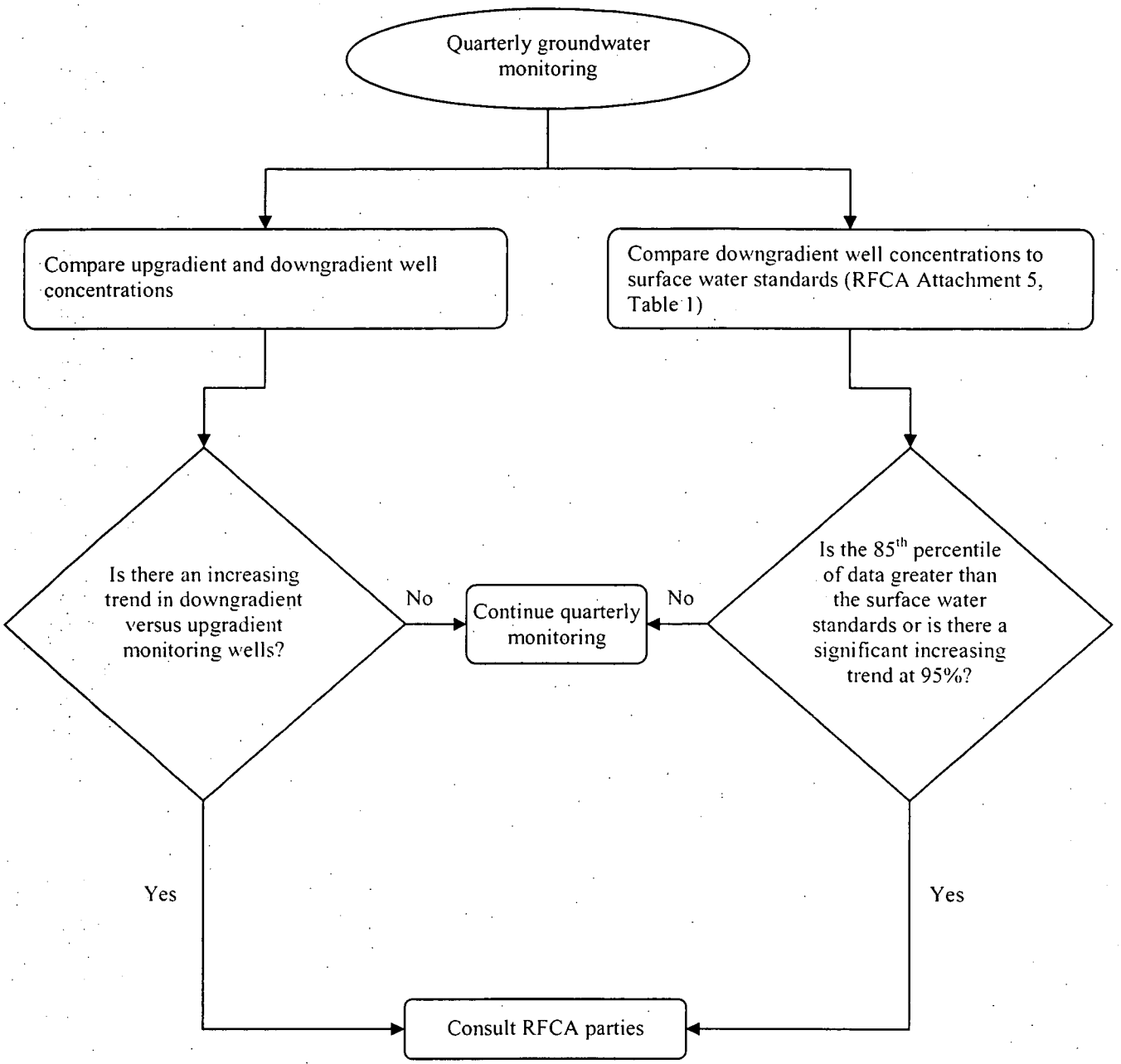
This section presents the groundwater monitoring plan for the Original Landfill during the post-closure period. The plan establishes consistent monitoring locations and frequencies for the monitoring period.

4.1 PURPOSE AND REQUIREMENTS

The Original Landfill groundwater monitoring plan has been implemented to determine groundwater quality impacts of the landfill (IM/IRA [Kaiser-Hill 2005]). The groundwater monitoring system was implemented under the IMP (Rocky Flats 2004) in accordance with 6 Code of Colorado Regulations 1007-3, 265.90[d]. The groundwater monitoring will be used to evaluate upgradient versus downgradient groundwater quality at the Original Landfill. Downgradient groundwater will also be compared to surface water standards (RFCA Attachment 5, Table 1).

4.2 DATA QUALITY OBJECTIVES

Detailed data quality objective (DQO) information can be found in Section 3.3 of the IMP. Groundwater monitoring wells at the Original Landfill are categorized as RCRA monitoring wells under the IMP and undergo a certain decision statement, as outlined in Section 3.3.10.7 of the IMP. The following flowchart will be used to guide the decision statement:


Quarterly groundwater monitoring
Compare upgradient and downgradient well concentrations
Compare downgradient well concentrations to surface water standards (RFCA Attachment 5, Table 1)
Is there an increasing trend in downgradient versus upgradient monitoring wells?
No
Continue quarterly monitoring
No
Is the 85th percentile of data greater than the surface water standards or is there a significant increasing trend at 95%?
Yes
Yes
Consult RFCA parties

4.3 WELL LOCATIONS

Well locations have been chosen in compliance with the IMP (Rocky Flats 2004) and include a total of four RCRA groundwater monitoring wells (Figure 4-1). Locations were selected and approved by both CDPHE and EPA. Of these, one is upgradient, and three are downgradient of the Original Landfill.

Upgradient monitoring wells include well P416589. Downgradient monitoring wells include wells 80005, 80105, and 80205. Monitoring well details are summarized in Table 4-1. Boring logs are included in Appendix B.

4.4 GROUNDWATER QUALITY SAMPLE PARAMETERS

Groundwater samples will be submitted for laboratory analysis for the following EPA-approved methods, which were established in the IM/IRA (Kaiser-Hill 2005):

- SW-846 Method 8260B – Volatile Organic Compounds (VOCs)
- SW-846 Method 8081A/8141A – Organochlorine and Organophosphorous Pesticides
- SW-846 Method 6010B – Metals (including uranium)
- SW-846 Method 7470A – Mercury

4.5 SAMPLING PROCEDURES SUMMARY

Groundwater sampling will be conducted in accordance with RFETS Standard Operating Procedures (SOPs). The following sections summarize the groundwater sampling procedures that will be used to monitor groundwater conditions at the Original Landfill. Details include groundwater level measurements, conventional groundwater purging and sampling procedures, quality control (QC) field samples, decontamination procedures, and investigation-derived waste (IDW) management.

4.5.1 Groundwater Level Measurement

Water levels are measured to determine groundwater flow patterns, water level fluctuations, and the volume of water in a well for the calculation of purge volumes prior to sampling. Since this plan requires measuring water levels from a group of monitoring wells for hydrologic evaluation, such measurements will be conducted as a complete round, separate from any sampling efforts.

The four RCRA monitoring wells will be included during water level measurements. Water levels will be measured in accordance with RFETS SOPs.

4.5.2 Conventional Groundwater Purging and Sampling

Monitoring wells will be purged before samples are withdrawn to prevent collection of non-representative stagnant water in a well. Well purging will be sufficient to increase the likelihood that the water collected is representative of the groundwater within the formation around the well. All purging and sampling operations will be conducted in accordance with RFETS SOPs.

4.5.3 Quality Control Field Samples

During implementation of the field sampling program, field quality assurance (QA)/QC samples will be collected to assess the reproducibility of the field collection techniques, the quality of preservation techniques and sample bottles, and the effectiveness of field decontamination procedures. QA/QC procedures are will be conducted in accordance with RFETS SOPs.

4.5.4 Decontamination

Equipment used in monitoring and sampling must be properly decontaminated. Decontamination must effectively eliminate the potential for cross-contamination between sampling locations and must be conducted using the appropriate materials to prevent the introduction of external contaminants (such as phosphate from detergents, aromatic hydrocarbons from motor vehicles, or oil and grease from dirty hands). Decontamination procedures will be conducted in accordance with RFETS SOPs.

4.5.5 Investigation-Derived Waste (IDW)

IDW that will accumulate during groundwater monitoring includes decontamination and purge water. Both will be drummed and transported off-site for disposal. The management of IDW will be conducted in accordance with RFETS SOPs.

4.6 LABORATORY PROCEDURES SUMMARY

Analytical methodologies and reporting limits (RLs), data reporting procedures, laboratory QA/QC procedures, laboratory data validation and contractor validation procedures are to be

conducted in accordance with EPA-approved methods. Groundwater samples will be submitted to an EPA-approved analytical laboratory for the analyses listed in Section 4.4.

Prior to implementing procedures, the laboratory will perform an initial demonstration of proficiency as specified in the method. Once the procedure is properly understood by the analyst and acceptable quality control data (precision and accuracy) are achieved, the method is placed in the laboratory for use.

Sample results are reported according to laboratory analytical method SOPs or contract specifications. The laboratory will report any analyte of interest detected at or above the RL as a positive value. Any analyte of interest not detectable or detected below the RL will be reported as "not detected" at the RL or an estimated value between the RL and the instrument or method detection limit. Data are generally reported in a tabular format or posted on maps and figures. RLs are adjusted for dilution when necessary.

4.7 DATA EVALUATION AND REPORTING

Groundwater monitoring results will be included in the Annual Original Landfill Monitoring Reports discussed in Section 6.0. Groundwater monitoring will be conducted on a quarterly basis at the Original Landfill.

5.0 SURFACE WATER MONITORING PLAN

As part of Original Landfill closure, surface water will be monitored at both upgradient and downgradient locations. This section presents the monitoring plan to determine whether surface water standards are met.

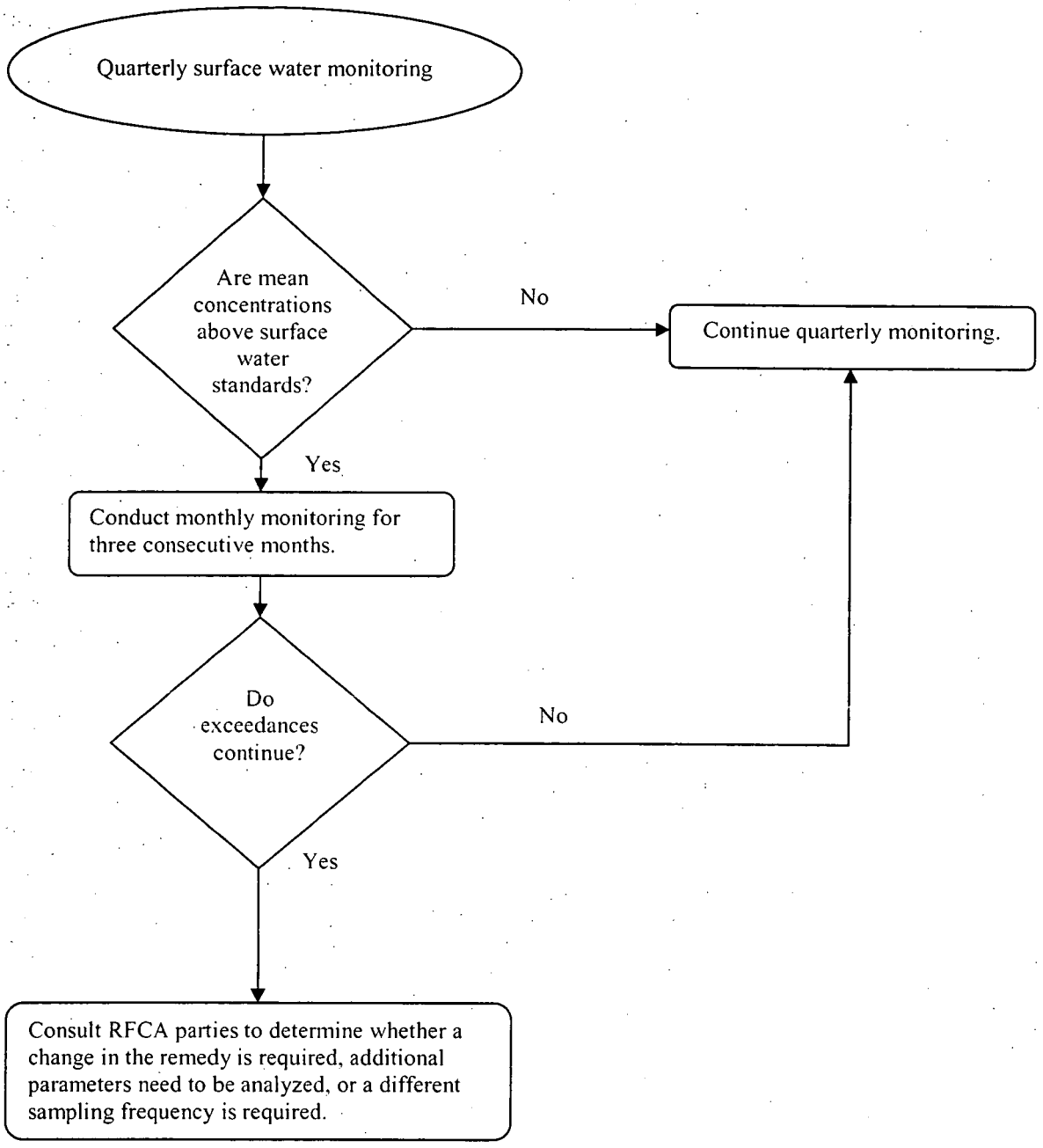
5.1 PURPOSE AND REQUIREMENTS

The Original Landfill surface water monitoring plan has been implemented to determine surface water quality impacts of the landfill (IM/IRA [Kaiser-Hill 2004]). Applicable surface water standards are listed in the RFCA, Attachment 5, Table 1.

As detailed in the IM/IRA, monitoring requirements will consist of quarterly monitoring until the first CERCLA review. A validated exceedance of an effluent limit will trigger monthly monitoring for three consecutive months. Continued exceedances during the three-month period will trigger consultation between the RFCA parties to determine whether a change in the remedy is required, additional parameters need to be analyzed, or a different sampling frequency is required.

5.2 DATA QUALITY OBJECTIVES

Surface water monitoring DQO information can be found in the IMP, Section 2 (Rocky Flats 2005). The following flowchart will be used to guide the decision statement.


Quarterly surface water monitoring
Are mean concentrations above surface water standards?
No
Continue quarterly monitoring.
Yes
Conduct monthly monitoring for three consecutive months.
Do exceedances continue?
No
Yes
Consult RFCA parties to determine whether a change in the remedy is required, additional parameters need to be analyzed, or a different sampling frequency is required.

5.3 SAMPLE LOCATIONS

Sampling will be conducted at the two locations shown on Figure 4-1, POM5 and POM6. Surface water flow will be manually measured (calibrated bucket and stop watch).

5.4 SURFACE WATER SAMPLE PARAMETERS

Surface water samples will be submitted for laboratory analysis for the following EPA-approved methods, which were established in the IM/IRA:

- SW-846 Method 8260B –VOCs
- SW-846 Method 6010B – Metals (including uranium)
- SW-846 Method 7470A – Mercury

5.5 SAMPLING PROCEDURES SUMMARY

The following sections detail the sampling procedures that will be used to monitor surface water. QC field samples, decontamination procedures, sample identification, and sample handling procedures are identical to those of the groundwater sampling.

Sampling Procedures

Surface water at the two locations will be sampled by directly placing a collection device or using a pond sampler device. The same collection suite, depending on effluent exceedances, will be taken at each sample location. The pond sampler can be purchased or easily fabricated with the following parts:

- One 250-milliliter (ml) polypropylene beaker (laboratory supply store),
- Adjustable clamp sized for 250-ml beakers (laboratory supply store),
- Aluminum telescoping tube equipped with bolt holes (swimming supply store), and
- Nuts/bolts to attach clamp to telescoping tube (hardware store).

Pond water from the sampler device will be poured directly into the sample containers. The device must be decontaminated in accordance with Section 4.5.4 between samples.

5.6 LABORATORY PROCEDURES SUMMARY

Analytical methodologies and RLs, data reporting procedures, laboratory QA/QC procedures, and laboratory data validation and contractor validation procedures are similar to those for groundwater sampling provided in Section 4.6.

5.7 REPORTING AND SCHEDULING

Surface water sampling results will be included in the Annual Original Landfill Monitoring Reports discussed in Section 6.0. Surface water monitoring will be conducted on a quarterly basis at the Original Landfill.

6.0 REPORTING AND CONTACT INFORMATION

6.1 REPORTING

The complete Annual Original Landfill Monitoring Report, including inspection results, repairs, groundwater monitoring data, and surface water monitoring data if applicable, will be submitted to the RFCA parties. Any maintenance action activities will be detailed in the report. If conditions appear that are of concern and require immediate attention, the RFCA parties will be notified immediately. The Annual Original Landfill Monitoring Report will include at a minimum:

- Monthly vegetation inspection forms for the first two growing seasons;
- Quarterly inspection forms;
- Notations of problems, maintenance action(s) taken, and maintenance or repairs as a result of the quarterly inspection;
- Any deviations from the Landfill Monitoring and Maintenance Plan and the rationale for such deviations;
- Summary of monitoring locations;
- Tables with depth to water, well elevations, and groundwater elevations;
- Table with groundwater results and associated qualifiers;
- Tables with surface water results and associated qualifiers;
- Figures with groundwater monitoring points and location(s) of problems and/or repairs; and
- Groundwater and surface water sampling forms.

6.2 CONTACT INFORMATION

The point of contact and contact information for the Original Landfill during the monitoring and maintenance phase is as follows:

Scott Surovchak/Department of Energy
Rocky Flats Project Office
12101 Airport Way, Unit A
Broomfield, CO 80021-2583
303-966-3551

30

7.0 REFERENCES

Earth Tech, Inc. 2005. *Final Design Analysis, Accelerated Action Design for the Original Landfill.* May.

EG&G. 1994. *Technical Memorandum No. 15, Addendum to Final Phase I RFI/RI Work Plan, Amended Field Sampling Plan, Volume 2, Woman Creek Priority Drainage, Rocky Flats Plant, Golden, Colorado.* May.

Kaiser-Hill Company, L.L.C. 2005. *Final Interim Measure/Interim Remedial Action for the Original Landfill.* March.

Rockwell. 1988. *Remedial Investigation and Feasibility Study Plans for Low Priority Sites, Volume I – Site Descriptions, Groupings and Prioritization.* June.

Rocky Flats. 2005. *RFETS Integrated Monitoring Plan FY2005, Revision 1, Background Document.* September.

TABLE

TABLE 4-1
GROUNDWATER MONITORING WELLS
PRESENT LANDFILL
1 OF 1

Well ID	Type	Installation Date	Screen Length (feet)	Borehole Depth (feet bgs)	Well Diameter (inches)	Depth to Top of Screen (feet bgs)	Depth to Bedrock (feet bgs)
70193	Upgradient	1/15/93	15	39.4	2	22.30	19.50
70393	Upgradient	2/2/93	15	26.0	2	7.80	22.80
70693	Upgradient	12/4/92	20	30.3	2	8.50	28.50
73005	Downgradient	6/27/05	20	28.0	2	4.60	0.00
73105	Downgradient	6/27/05	20	27.7	2	5.65	12.50
73205	Downgradient	6/27/05	25	32.0	2	4.55	4.20

Notes:
bgs below ground surface

TABLE 4-2
GROUNDWATER SAMPLING PARAMETERS
PRESENT LANDFILL
1 OF 3

Parameter ID	Parameter Name
ORGANICS	
	Volatile Organic Compounds
67-64-1	Acetone
71-43-2	Benzene
108-86-1	Bromobenzene
74-97-5	Bromochloromethane
75-27-4	Bromodichloromethane
75-25-2	Bromoform
74-83-9	Bromomethane
78-93-3	2-Butanone (MEK)
104-51-8	n-Butylbenzene
135-98-8	sec-Butylbenzene
98-06-6	tert-Butylbenzene
75-15-0	Carbon Disulfide
56-23-5	Carbon Tetrachloride
108-90-7	Chlorobenzene
75-00-3	Chloroethane
67-66-3	Chloroform
74-87-3	Chloromethane
95-49-8	2-Chlorotoluene
106-43-4	4-Chlorotoluene
96-12-8	1,2-Dibromo-3-chloropropane
124-48-1	Dibromochloromethane
106-93-4	1,2-Dibromomethane (EDB)
74-95-3	Dibromomethane
95-50-1	1,2-Dichlorobenzene
541-73-1	1,3-Dichlorobenzene
106-46-7	1,4-Dichlorobenzene
75-71-8	Dichlorodifluoromethane
75-34-3	1,1-Dichloroethane
107-06-2	1,2-Dichloroethane
75-35-4	1,1-Dichloroethylene
156-59-2	cis-1,2-Dichloroethylene
156-60-5	trans-1,2-Dichloroethylene
78-87-5	1,2-Dichloropropane
142-28-9	1,3-Dichloropropane
594-20-7	2,2-Dichloropropane
563-58-6	1,1-Dichloropropene
10061-01-5	cis-1,3-Dichloropropene
10061-02-6	trans-1,3-Dichloropropene

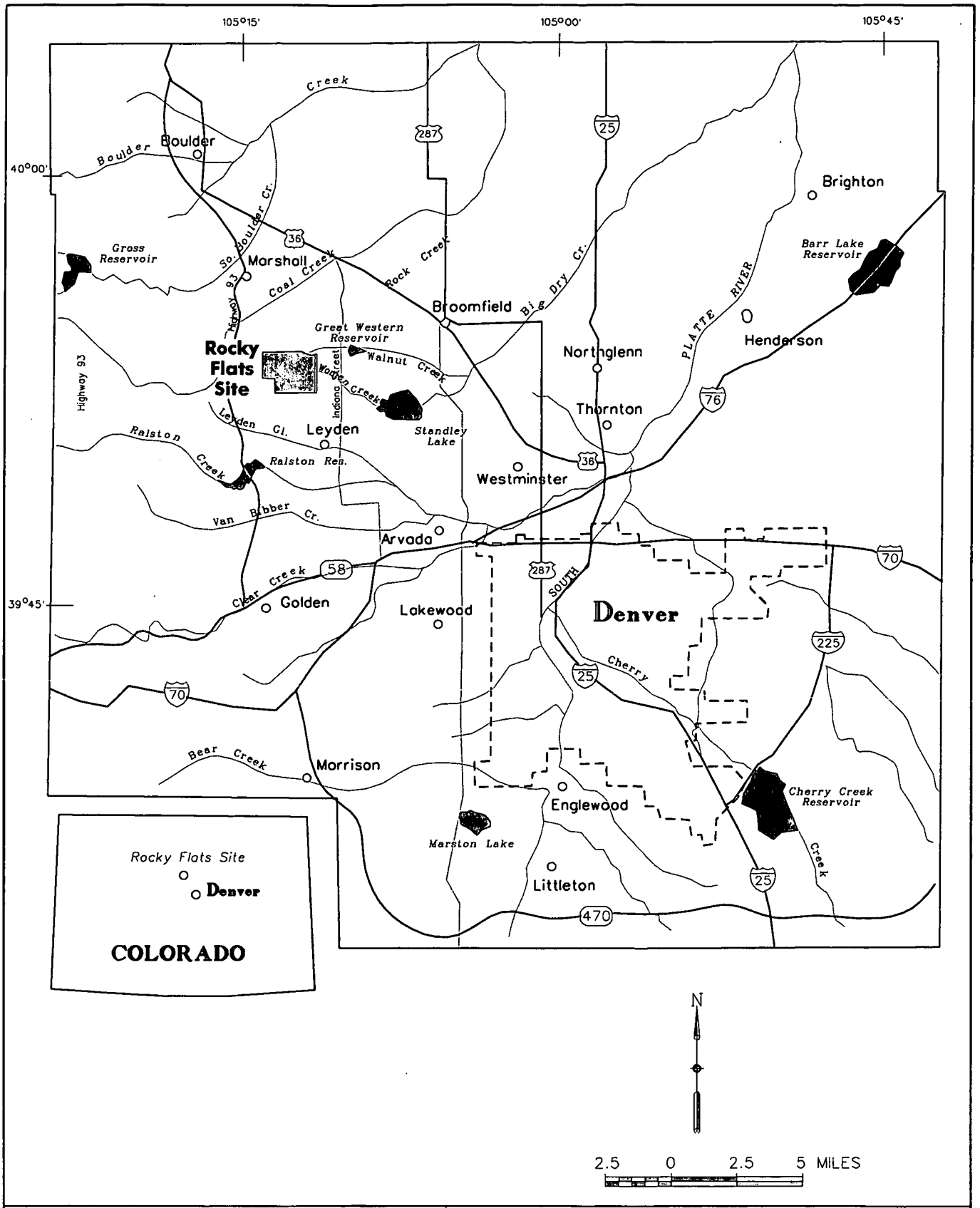
TABLE 4-2
GROUNDWATER SAMPLING PARAMETERS
PRESENT LANDFILL
2 OF 3

Parameter ID	Parameter Name
100-41-4	Ethyl Benzene
87-68-3	Hexachlorobutadiene
591-78-6	2-Hexanone
98-82-8	Isopropylbenzene
99-87-6	p-Isopropyltoluene
108-10-1	4-Methyl-2-pentanone (MIBK)
75-09-2	Methylene Chloride
91-20-3	Napthalene
103-65-1	n-Propylbenzene
100-42-5	Styrene
630-20-6	1,1,1,2-Tetrachloroethane
79-34-5	1,1,2,2-Tetrachloroethane
127-18-4	Tetrachloroethylene
108-88-3	Toluene
87-61-6	1,2,3-Trichlorobenzene
120-82-1	1,2,4-Trichlorobenzene
71-55-6	1,1,1-Trichloroethane
79-00-5	1,1,2-Trichloroethane
79-01-6	Trichloroethylene
75-69-4	Trichlorofluoromethane
96-18-4	1,2,3-Trichloropropane
76-13-1	1,1,2-Trichlorotrifluoroethane
95-63-6	1,2,4-Trimethylbenzene
108-67-8	1,3,5-Trimethylbenzene
75-01-4	Vinyl Chloride
1330-20-7	Xylenes
INORGANICS	
Pesticides	
57-74-9	Chordone
72-20-8	Endrin
76-44-8	Heptachlor
58-89-9	Lindane
72-43-5	Methoxychlor
800-135-2	Toxaphene
Metals	
7429-90-5	Aluminum
7440-36-0	Antimony
7440-38-2	Arsenic
7440-39-3	Barium
7440-41-7	Beryllium
7440-43-9	Cadmium

TABLE 4-2
GROUNDWATER SAMPLING PARAMETERS
PRESENT LANDFILL
3 OF 3

Parameter ID	Parameter Name
7440-70-2	Calcium
7440-47-3	Chromium
7440-48-4	Cobalt
7440-50-8	Copper
7439-89-6	Iron
7439-92-1	Lead
7439-93-2	Lithium
7439-95-4	Magnesium
7439-96-5	Manganese
7439-97-6	Mercury
7439-98-7	Molybdenum
7440-02-0	Nickel
7440-09-7	Potassium
7782-49-2	Selenium
7440-22-4	Silver
7440-23-5	Sodium
7440-24-6	Strontium
7440-28-0	Thallium
7440-31-5	Tin
11-09-6	Uranium
7440-62-2	Vanadium
7440-66-6	Zinc

FIGURES



DATE: 12/8/2004

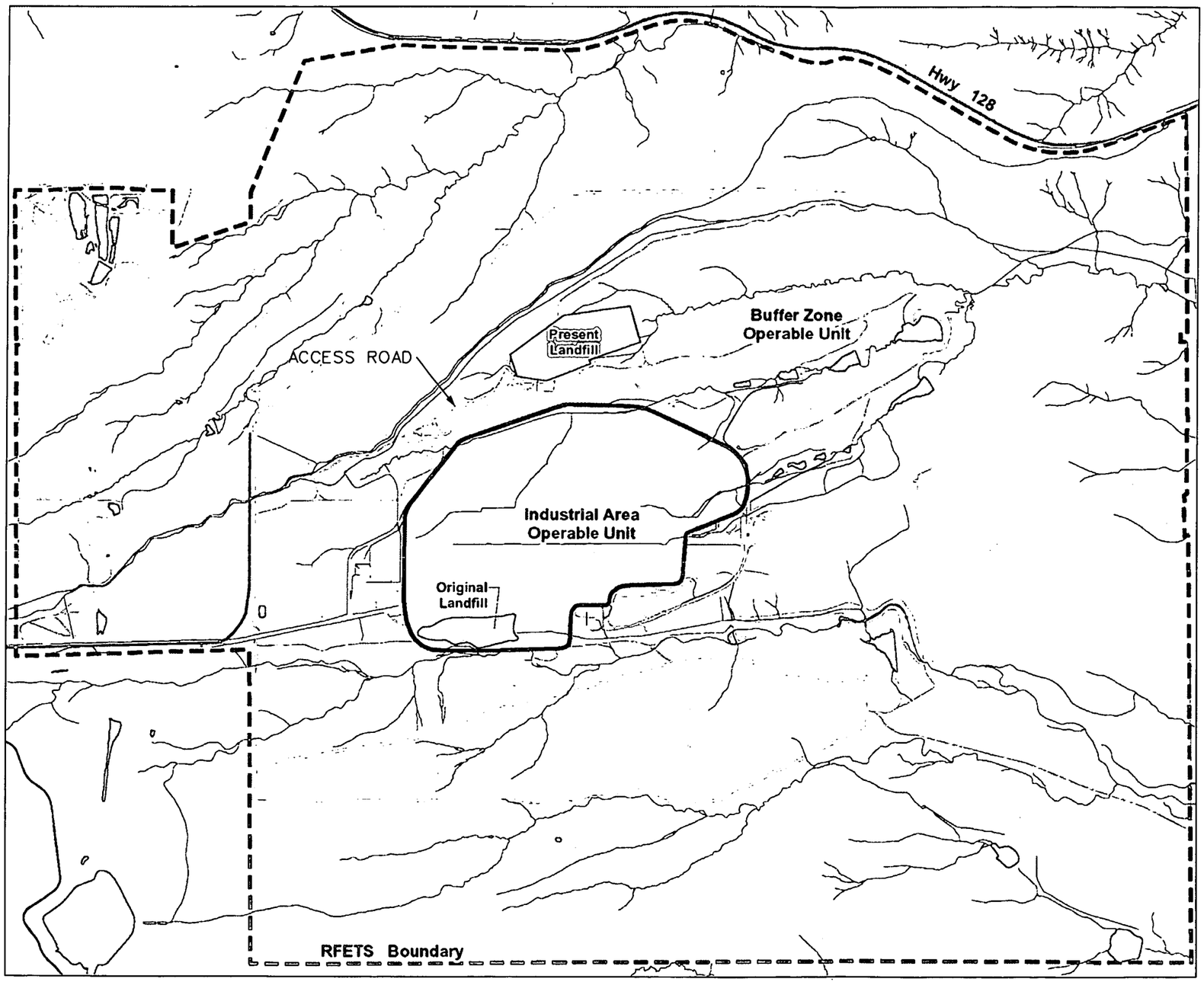
CAD FILE: GROUP\CAD\ROCKY_FLATS\NEWDESIGN_2004\PLFMM\LOCATION.DGN

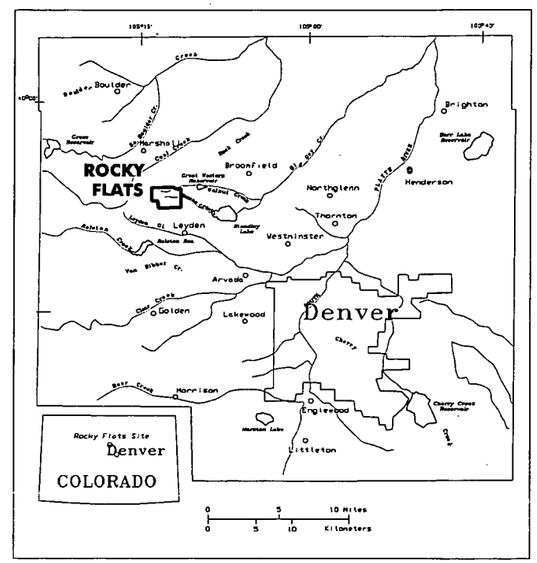
EARTH TECH

FIGURE 1-1

LOCATION MAP

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO





EARTH TECH

FIGURE 1–2

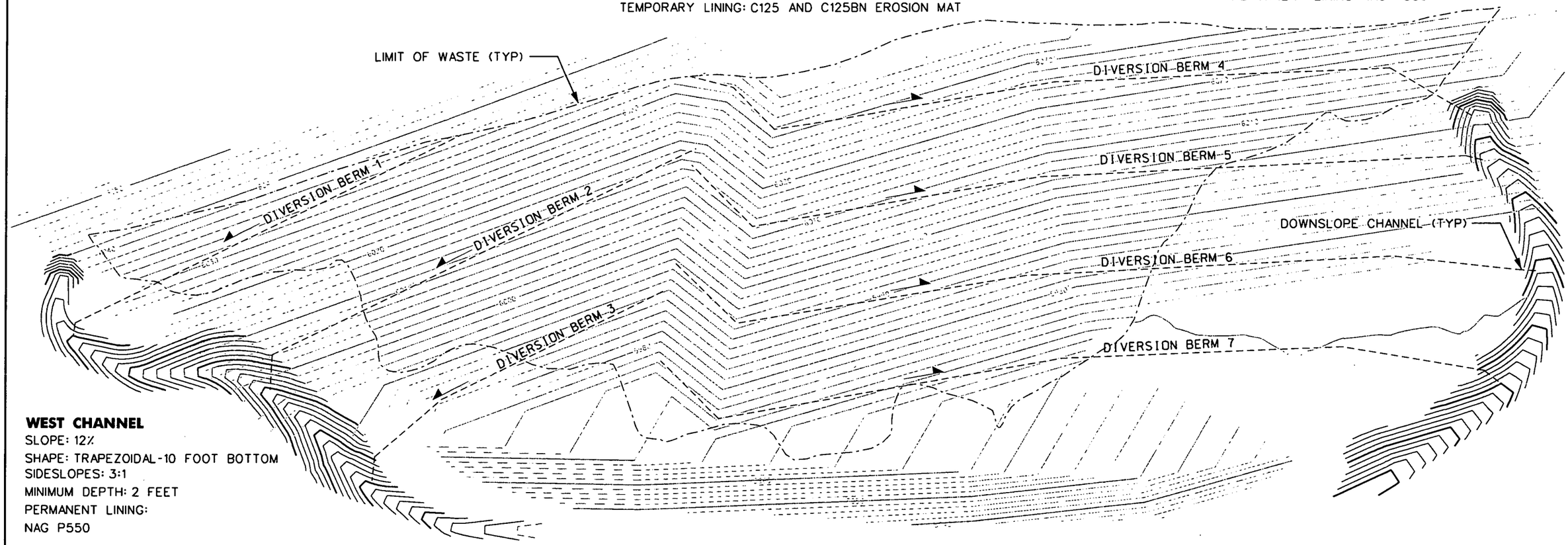
ORIGINAL LANDFILL SITE MAP

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

L\GROUP\CAD\ROCKY_FLATS\OLF_805Figs\HaulRte1.dgn DATE: 8/23/05

DIVERSION BERMS 1,2,3,4,5,6,7
SLOPE: 2%
SHAPE: TRIANGULAR
HEIGHT: 3 FEET
PERMANENT LINING: GRASS
TEMPORARY LINING: C125 AND C125BN EROSION MAT

EAST CHANNEL
SLOPE: 12%
SHAPE: TRAPEZOIDAL-18 FOOT BOTTOM
SIDESLOPES: 3:1 TO 4:1
MINIMUM DEPTH: 2 FEET
PERMANENT LINING: NAG P550



WEST CHANNEL
SLOPE: 12%
SHAPE: TRAPEZOIDAL-10 FOOT BOTTOM
SIDESLOPES: 3:1
MINIMUM DEPTH: 2 FEET
PERMANENT LINING:
NAG P550

N

60 0 60 120 FEET

LEGEND
- DIVERSION BERM
- CHANNEL
- LIMIT OF WASTE

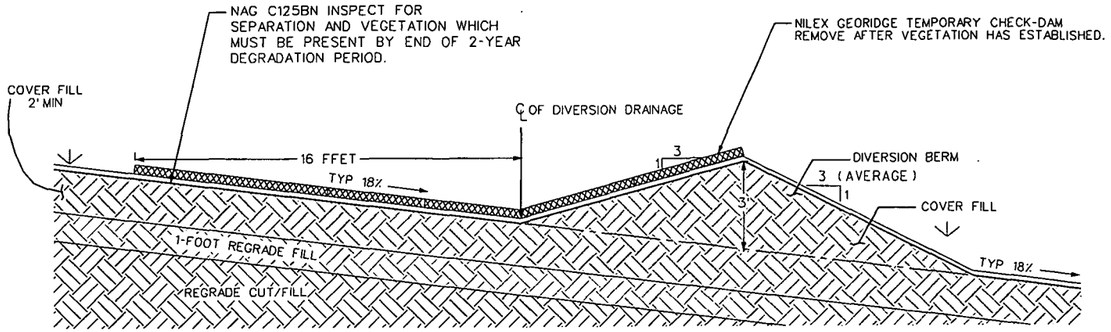
EARTH TECH

FIGURE 2-1

ORIGINAL LANDFILL COVER

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

L\GROUP\CAD\ROCKY_FLATS\OLF_805Figs\Surfrev2.dgn DATE: 12/8/04

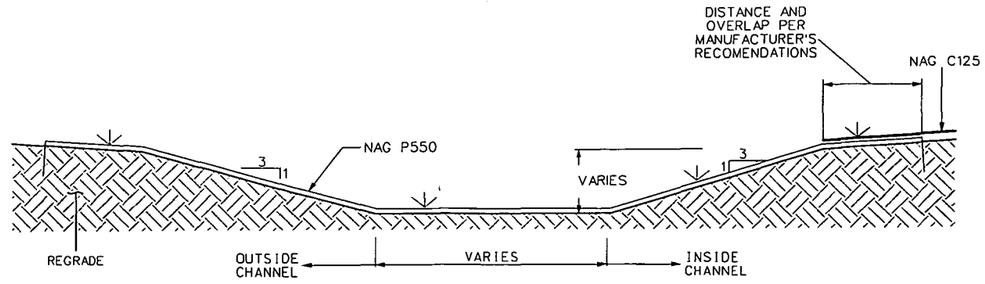


SECTION

NOTE: IN AREAS OUTSIDE OF THE WASTE "FOOTPRINT" COVER SOIL MAY BE LESS THAN 2' (IN TRANSITION AREAS) OR NO COVER SOIL

DIVERSION BERM (SECTION)

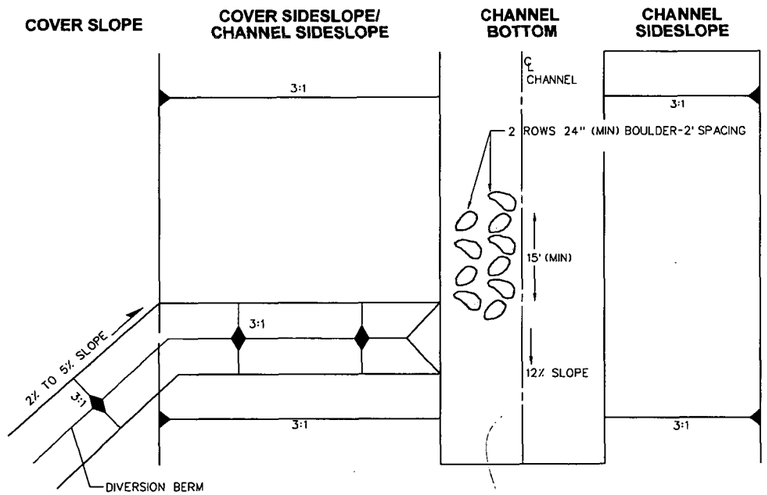
NTS



SECTION

PERMANENT/GRASS-LINED CHANNEL DETAIL (SECTION)

NTS

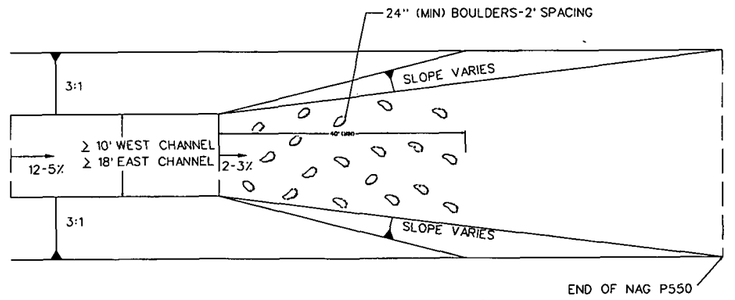


PLAN VIEW

NOTE: NAG P550 EROSION MAT ON CHANNEL BOTTOM, CHANNEL SIDESLOPES, DOWNSLOPE CHANNEL BOTTOM, AND DOWNSLOPE CHANNEL SIDESLOPES.

DOWNSLOPE CHANNEL TRANSITION FROM DIVERSION BERM TO CHANNEL (PLAN VIEW)

NTS



PLAN VIEW

END CHANNEL (PLAN VIEW)

NTS

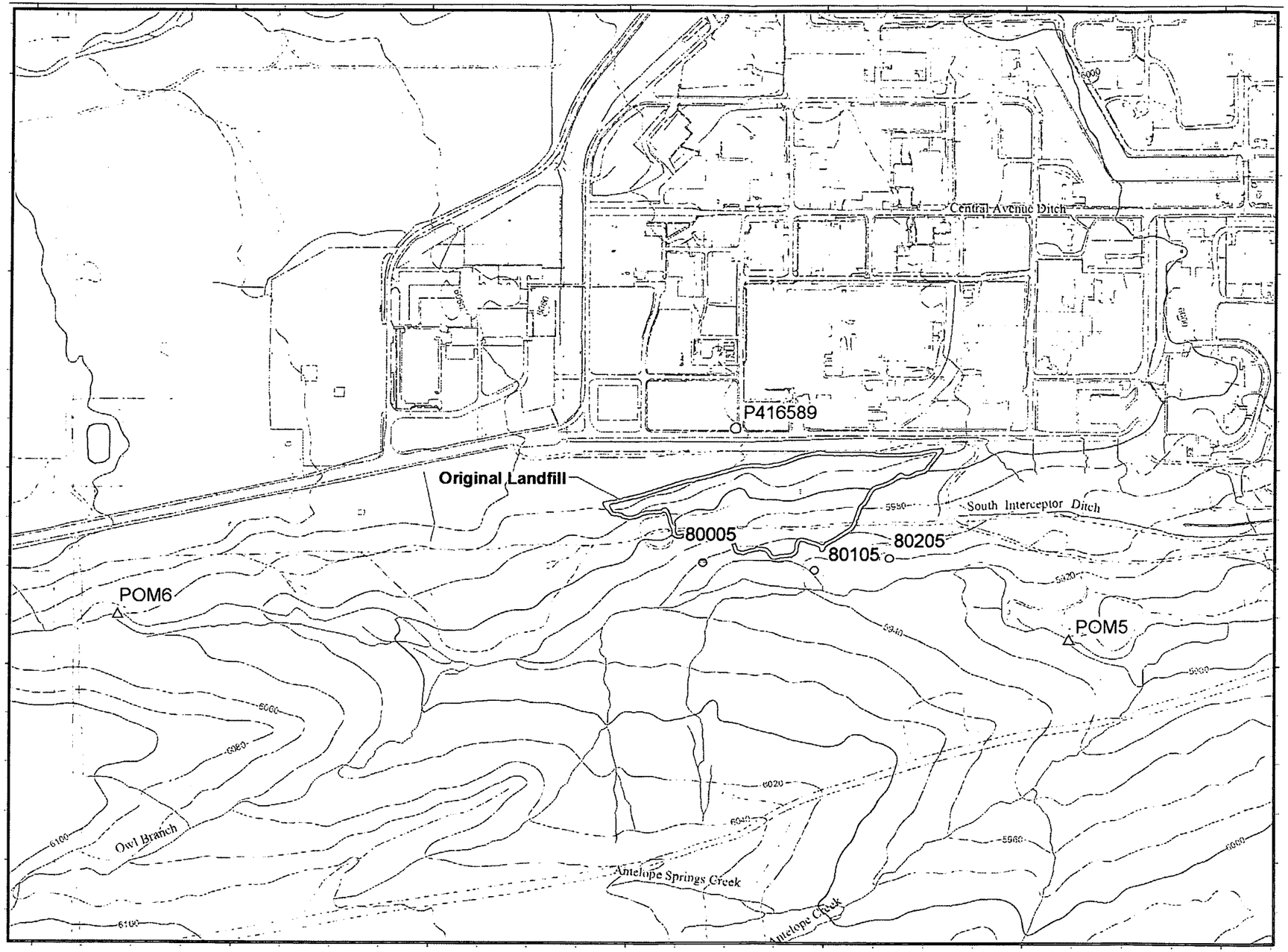
EARTH TECH

FIGURE 3-1

ORIGINAL LANDFILL STORMWATER MANAGEMENT STRUCTURE DETAILS

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

L\GROUP\CAD\ROCKY_FLATS\OLF_805Figs\DETAILREV3.dgn DATE: 8/26/05



Legend

- Groundwater monitoring well
- Surface water monitoring location
- Waste material boundary

Standard Map Features

- Lake or pond
- Stream, ditch, or other drainage feature
- Paved road
- Dirt road
- Trail
- Fence
- Topographic contour (20 foot)

EARTH TECH

FIGURE 4-1

ORIGINAL LANDFILL GROUNDWATER AND SURFACE WATER MONITORING

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

L\GROUP\CAD\ROCKY_FLATS\OLF_805Figs\GwSurf.dgn DATE: 8/26/05

APPENDIX A

ORIGINAL LANDFILL – MONITORING AND MAINTENANCE PROGRAM INSPECTION FORM

ORIGINAL LANDFILL – MONITORING AND MAINTENANCE PROGRAM

INSPECTION FORM

INSPECTOR: _____ DATE: _____

TEMPERATURE: _____ WEATHER CONDITIONS: _____

SUBSIDENCE / CONSOLIDATION

REGION	EVIDENCE OF CRACKS?	EVIDENCE OF DEPRESSIONS?	EVIDENCE OF SINK HOLES?	OTHER (DESCRIBE BELOW)
COVER – WEST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
COVER – EAST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
BUTTRESS FILL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 1	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 3	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 4	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 5	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 6	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
DIVERSION BERM 7	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	

MAINTENANCE REQUIRED / COMMENTS

_____

_____

_____

45

SLOPE STABILITY

REGION	EVIDENCE OF SEEPS?	EVIDENCE OF BLOCK OR CIRCULAR FAILURE?	EVIDENCE OF BLOCK OR CIRCULAR FAILURE?
COVER – WEST	☐ Yes ☐ No	☐ Yes ☐ No	
COVER – EAST	☐ Yes ☐ No	☐ Yes ☐ No	
BUTTRESS FILL SIDESLOPE	☐ Yes ☐ No	☐ Yes ☐ No	
WEST PERIMETER CHANNEL SIDESLOPES	☐ Yes ☐ No	☐ Yes ☐ No	
EAST PERIMETER CHANNEL SIDESLOPES	☐ Yes ☐ No	☐ Yes ☐ No	
COVER SEEPS (IF PRESENT)	☐ Yes ☐ No	☐ Yes ☐ No	

MAINTENANCE REQUIRED / COMMENTS

SOIL COVER

REGION	EVIDENCE OF SOIL DEPOSITION OR EROSION?	EVIDENCE OF EROSION RILLS/GULLIES?	EVIDENCE OF BURROWING ANIMALS?	OTHER (DESCRIBE BELOW)
COVER – WEST	☐ Yes ☐ No	☐ Yes ☒ No	☐ Yes ☐ No	
COVER – EAST	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
BUTTRESS FILL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
BUTTRESS FILL SIDESLOPE	☐ Yes ☐ No	☐ Yes ☒ No	☐ Yes ☐ No	

MAINTENANCE REQUIRED / COMMENTS

VEGETATION

REGION	CONDITION OF GRASS	UNWANTED VEGETATION PRESENT*?	PERCENTAGE OF GRASS VERSUS BARE GROUND?	PERCENTAGE OF UNWANTED VEGETATION?
COVER- WEST		☐ Yes ☐ No		
COVER - EAST		☐ Yes ☐ No		
DIVERSION BERM 1		☐ Yes ☐ No		
DIVERSION BERM 2		☐ Yes ☐ No		
DIVERSION BERM 3		☐ Yes ☐ No		
DIVERSION BERM 4		☐ Yes ☐ No		
DIVERSION BERM 5		☐ Yes ☐ No		
DIVERSION BERM 6		☐ Yes ☐ No		
DIVERSION BERM 7		☐ Yes ☐ No		
WEST PERIMETER CHANNEL		☐ Yes ☐ No		
EAST PERIMETER CHANNEL		☐ Yes ☐ No		
UPPER BUTTERESS FILL SIDESLOPE		☐ Yes ☐ No		
LOWER BUTTRESS FILL SIDESLPOE		☐ Yes ☐ No		

* Unwanted vegetation includes weeds and deep-rooting trees.

MAINTENANCE REQUIRED / COMMENTS

STORMWATER MANAGEMENT STRUCTURES

CHANNELS / LINING

STRUCTURE	EVIDENCE OF EXCESSIVE EROSION, GULLYING, SCOUR, OR UNDERMINING?	EVIDENCE OF SETTLEMENT/ SUBSIDENCE OR DEPRESSIONS?	EVIDENCE OF BREACHING OR BANK FAILURE?	EVIDENCE OF BURROWING ANIMALS?	EVIDENCE OF SEDIMENT BUILD-UP OR OTHER BLOCKAGE?	EVIDENCE OF LINING DETERIORATION, HOLES, RIPS, OR SEPARATION?	EVIDENCE OF LINING DISPLACEMENT?
DIVERSION BERM 1	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DIVERSION BERM 2	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DIVERSION BERM 3	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DIVERSION BERM 4	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DIVERSION BERM 5	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DIVERSION BERM 6	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
DIVERSION BERM 7	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
CHECK DAMS	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
WEST PERIMETER CHANNEL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
EAST PERIMETER CHANNEL	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

OTHER DEFICIENCIES?

MAINTENANCE REQUIRED / COMMENTS

STORMWATER MANAGEMENT STRUCTURES (CONTINUED)

OUTFALLS

CHECK EACH STRUCTURE FOR EXCESSIVE EROSION AND SEDIMENT DEPTH. IF SEDIMENT DEPTH IS COMPROMISING THE DESIGN CHARACTERISTICS, REMOVE SEDIMENT.

STRUCTURE	CONDITION / SEDIMENT DEPTH
DIVERSION BERM OUTFALL 1	
DIVERSION BERM OUTFALL 2	
DIVERSION BERM OUTFALL 3	
DIVERSION BERM OUTFALL 4	
DIVERSION BERM OUTFALL 5	
DIVERSION BERM OUTFALL 6	
DIVERSION BERM OUTFALL 7	
WEST PERIMETER CHANNEL OUTFALL	
EAST PERIMETER CHANNEL OUTFALL	
FRENCH DRAIN OUTFALL (SID)	

OTHER DEFICIENCIES?

MAINTENANCE REQUIRED / COMMENTS

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EROSION CONTROL

AREA	ADVERSELY AFFECTING OLF?		
NORTH OF THE ORIGINAL LANDFILL	☐ Yes	☐ No	COMMENT:
WEST OF THE WEST PERIMETER CHANNEL	☐ Yes	☐ No	COMMENT:
EAST OF THE EAST PERIMETER CHANNEL	☐ Yes	☐ No	COMMENT:
NORTH OF WOMAN CREEK	☐ Yes	☐ No	COMMENT:

MAINTENANCE REQUIRED

INSTITUTIONAL CONTROLS

ITEM			
EVIDENCE OF EXCAVATION(S) OF COVER AND IMMEDIATE VICINITY OF COVER?	☐ Yes	☐ No	COMMENT:
EVIDENCE OF CONSTRUCTION OF ROADS, TRAILS ON COVER OR BUILDINGS?	☐ Yes	☐ No	COMMENT:
EVIDENCE OF DRILLING OF WELLS OR USE OF GROUNDWATER?	☐ Yes	☐ No	COMMENT:
DAMAGE OR REMOVAL OF ANY SIGNAGE OR GROUNDWATER MONITORING WELLS?	☐ Yes	☐ No	COMMENT:

OTHER DEFICIENCIES?

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ACTION ITEMS

DEFICIENCY	DATE NOTED	ACTION	DATE COMPLETED	COMMENTS

SIGNATURE: _____ DATE: _____

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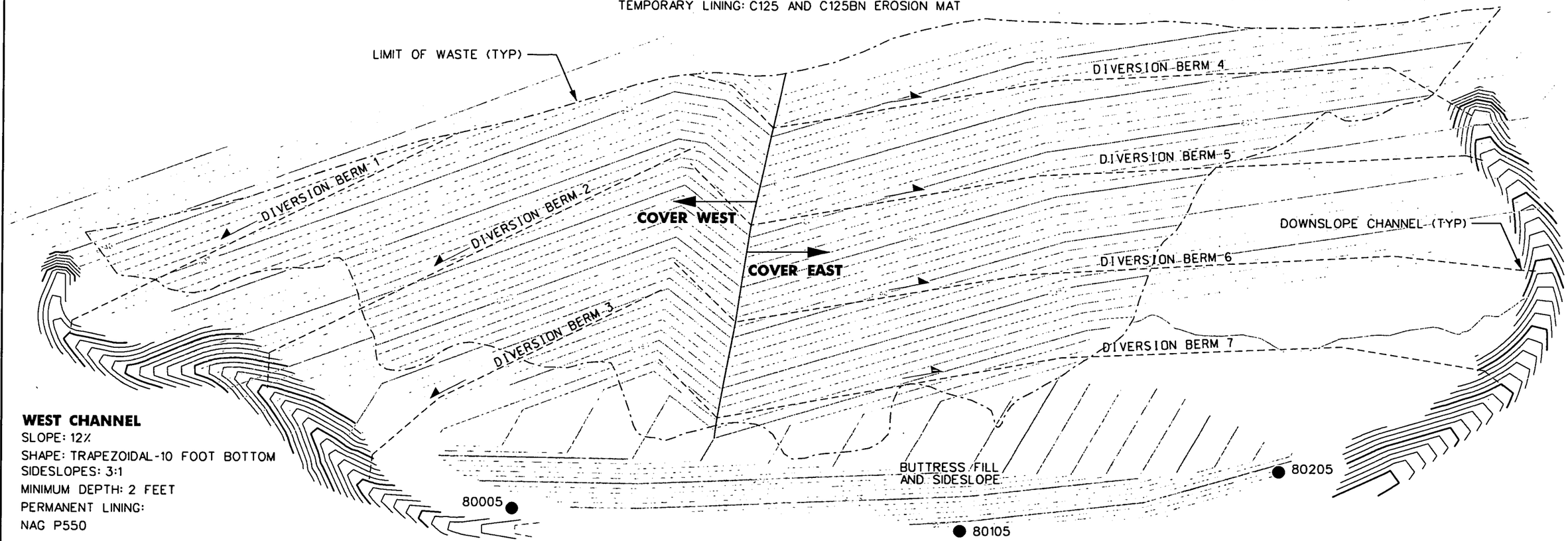
DIVERSION BERMS 1,2,3,4,5,6,7
SLOPE: 2%
SHAPE: TRIANGULAR
HEIGHT: 3 FEET
PERMANENT LINING: GRASS
TEMPORARY LINING: C125 AND C125BN EROSION MAT

EAST CHANNEL
SLOPE: 12%
SHAPE: TRAPEZOIDAL-18 FOOT BOTTOM
SIDESLOPES: 3:1 TO 4:1
MINIMUM DEPTH: 2 FEET
PERMANENT LINING: NAG P550



WEST CHANNEL
SLOPE: 12%
SHAPE: TRAPEZOIDAL-10 FOOT BOTTOM
SIDESLOPES: 3:1
MINIMUM DEPTH: 2 FEET
PERMANENT LINING:
NAG P550

N

60 0 60 120 FEET

LEGEND
- DIVERSION BERM
- CHANNEL
- LIMIT OF WASTE
- GROUNDWATER MONITORING WELL

EARTH TECH

ORIGINAL LANDFILL INSPECTIONS

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

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L\GROUP\CAD\ROCKY_FLATS\OLF_805Figs\Surfrev2a.dgn DATE: 10/6/05

APPENDIX B

GROUNDWATER WELL BORING LOGS / CONSTRUCTION SUMMARIES

STATE PLANE COORDINATE:
NORTH: 749211
EAST: 2081546

TOTAL DEPTH (FT): 36.5
AREA: PLANT
LOCATOR NUMBER: I8

GROUND ELEVATION (FT): 6041.20
CASING DIAMETER (IN): 2-3/8 O.D.
BOREHOLE DIAMETER (IN): 7.25

OLD WELL NUMBER: P260-89
GEOLOGIST: SPC
DATE DRILLED: 09/14/89

LOG OF BORING NUMBER: P416589

REMARKS: Hollow Stem Auger. Weston Log.

SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
				6041	0				Asphalt.
5089002			2.00 /2.00	6040	1			SM:	Silty Sand - olive gray (5 Y 4/1), non-stratified. F.g. to v.c.g. sand. Trace gravel, poor sorting, sub-angular, quartzose, granite. Dense, moist.
5089003								CL:	Gravelly Sandy Clay - olive black (5 Y 2/2), mod. brown (5 YR 3/4), mod. reddish brown (10 R 4/6), non-stratified. F.g. to v.c.g. sand. 1 cm. to 4 cm. gravel, poor sorting, sub-angular, quartzose. Very stiff, low plasticity, moist.
				6039	2			CL:	Gravelly Sandy Clay - same as above, no olive black.
5089004			1.40 /2.00	6038	3			CL:	Gravelly Sandy Clay - same as above. Varicolored, with grayish red (5 R 4/2), light brown (5 YR 5/6). Trace cobbles.
5089006				6037	4			SC:	Gravelly Clayey Sand - light brown (5 YR 5/6), pale yellowish brown (10 YR 6/2), non-stratified. F.g. to v.c.g. sand, 1 cm. to 7 cm. gravel, some silt, trace cobbles, poor sorting, sub-angular, quartzose. Low to no plasticity, dense, moist.
5089007			1.10 /2.00	6036	5				
				6035	6			SC:	Gravelly Clayey Sand - same as above. Calcareous in part.
5089008			1.20 /2.00	6034	7				
				6033	8			SC:	Gravelly Clayey Sand - same as above, as indicated by cuttings.
			0.00 /2.00	6032	9				
					10				

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STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 36.5	GROUND ELEVATION (FT):	6041.20	OLD WELL NUMBER:	P260-89	LOG OF BORING NUMBER:	
NORTH: 748211	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	SPC		P416589
EAST: 2081546	LOCATOR NUMBER: I8	BOREHOLE DIAMETER (IN):	7 25	DATE DRILLED:	09/14/89		
REMARKS: Hollow Stem Auger. Weston Log.							

SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM(FT)	DEPTH(FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	OX	100% OX	100%						
			9.00 /1.00	6031	10			SC:	Gravelly Clayey Sand - same as above, as indicated by cuttings.
			0.00 /1.00	6030	11			SC:	Gravelly Clayey Sand - same as above, as indicated by cuttings.
				6029	12			SC:	Gravelly Clayey Sand - banded, varicolored, mod. red (5 R 5/4), pale reddish brown (10 R 5/4), light brown (5 YR 5/6), dark yellowish orange (10 YR 6/6), yellowish gray (5 Y 7/2), non-stratified. F g. to v c.g. sand, some gravel, some silt, poor sorting, sub-angular, quartzose. Low plasticity, iron staining, calcareous. 0.5 cm. lense of Silty Clay, dense to med. dense, damp.
260891214			1.50 /2.00	6028	13				
260891216									
260891415			0.40 /0.70	6027	14			SC:	Gravelly Clayey Sand - same as above, with scattered cobbles.
			0.00 /1.30	6026	15			NO SAMPLE:	NO SAMPLE.
260891618				6025	16			SC:	Gravelly Clayey Sand - same as above. Increased clay content.
260891620			1.30 /2.00	6024	17				
260891820				6023	18			SM:	Gravelly Silty Sand - same as above. Light brown (5 YR 5/6), light olive gray (5 Y 6/1). Some clay, quartzose.
			0.50 /2.00	6022	19				
					20				

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STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 36.5	GROUND ELEVATION (FT):	6041.20	OLD WELL NUMBER:	P260-89	LOG OF BORING NUMBER:	
NORTH: 748211	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	SPC		P416589
EAST: 2081546	LOCATOR NUMBER: I8	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/14/89		

REMARKS: Hollow Stem Auger. Weston Log.

SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM(FT)	DEPTH(FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	CLAY SILT SAND GRAVEL	100% OR 100%							
P76089202			2.00 /2.00	6021	20			SC	Gravelly Clayey Sand - same as above. Light brown (5 YR 5/6), pale yellowish orange (10 YR 8/6), pale reddish brown (10 R 5/4), banded. No cobbles.
P76089204				6020	21				
P76089224			0.90 /2.00	6019	22			SC	Gravelly Clayey Sand - same as above. Trace cobbles, quartzose to granites.
				6018	23				
P76089226			1.60 /2.00	6017	24			SC	Gravelly Clayey Sand - same as above, with very thin lenses (3 cm.) of very Silty Sand at 25.3' to 25.4'.
P76089228				6016	25				
				6015	26			CL	Gravelly Sandy Clay - same as above.
P76089230			2.00 /2.00	6014	27	01/16/90 ▽		CL	Sandy Clay - pale reddish brown (10 R 5/4), dark yellowish orange (10 YR 6/6), light olive gray (5 Y 6/1), mottled, non-stratified. V.f.g. to f.g. sand. Some silt, very stiff, med. plasticity, damp.
						09/14/89 ▽		SC	Clayey Sand - mod. reddish brown (10 R 4/6), light brown (5 YR 5/6), non-stratified. F.g. to c.g. sand, some silt, poor sorting, sub-angular. Iron staining, low plasticity, dense, damp.
P76089232			1.10 /2.00	6013	28				
P76089233				6012	29			SM	Silty Sand - same as above. Some clay. Trace of gravel, no plasticity, wet.
					30				

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STATE PLANE COORDINATE:	TOTAL DEPTH (FT): 36.5	GROUND ELEVATION (FT):	6041.20	OLD WELL NUMBER:	P260-89	LOG OF BORING NUMBER:	
NORTH: 749211	AREA: PLANT	CASING DIAMETER (IN):	2-3/8 O.D.	GEOLOGIST:	SPC		
EAST: 2081596	LOCATOR NUMBER: 18	BOREHOLE DIAMETER (IN):	7.25	DATE DRILLED:	09/14/89	P416589	

REMARKS: Hollow Stem Auger. Weston Log.

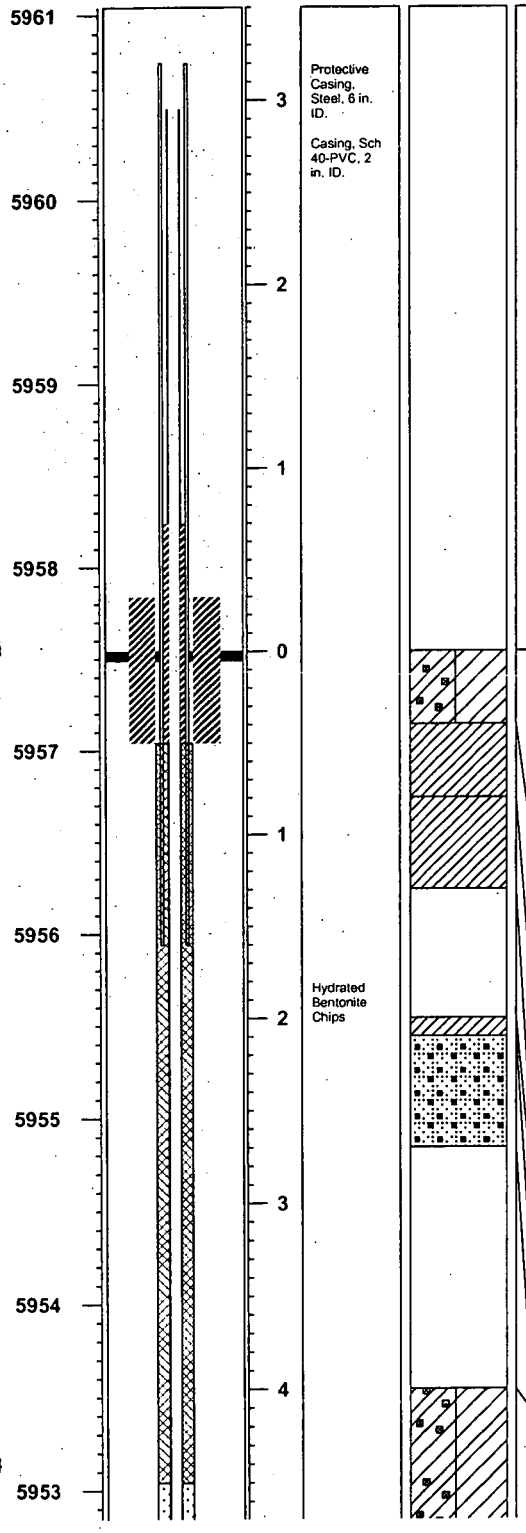
SAMPLE NUMBER	SAMPLE GRAIN SIZE	PERCENT RECOVERY	RECOVERY/ INTERVAL	DATUM (FT)	DEPTH (FT)	WELL OR PIEZOMETER CONSTRUCTION	LITHOLOGY	UNIFIED SOILS CLASSIFICATION OR ROCK TYPE	DESCRIPTION
	CSX	LOOSE CSX	LOOSE						
				6011	30			SM:	Silty Gravelly Sand - same as above.
2A0893002			2.00 /2.00	6010	31			CLAYSTONE:	Top of Bedrock. Yellowish gray (5 Y 7/2), dusky yellowish orange (10 YR 6/6), mottled, blocky, med. high plasticity, weathered, oxidized, med. hard, damp, minor silty sand laminations.
2A0893Z4				6009	32			CLAYSTONE:	Same as above.
2A0893Z5			0.20 /2.00	6008	33				
2A0893Z6			0.40 /1.00	6007	34			CLAYSTONE:	Same as above - silty. Trace sand, med. plastic.
				6006	35			CLAYSTONE:	Same as above - some silt to silty
2A0893Z7			1.50 /1.50	6005	36				TD = 36.5'
				6004	37				
				6003	38				
				6002	39				
					40				

STATE PLANE COORDINATES AREA:
NORTH: 747489.979
EAST: 2081404.042
PROJECT: Original Landfill
REMARKS:
Routine well installation

GRND ELEV. (FT): 5957.54
TOTAL DEPTH (FT): 21.0
COMPLETION DATE: 8/9/05
GEOLOGIST: E. Warp

CASING DIA (IN): 2"
BH DIA. (IN): 8"
GRID LOCATOR:

LOG OF BORING NUMBER: 80005



Lithology	Unified Soils Classification or Rock Type	Lithologic Description
		GC/CL: Gravelly, Sandy Clay with silt, brown (7.5YR4/4). 8 - 10% gravel (1/8" - 1/4" diameter, subangular to subrounded, composed of granite, schist, and quartzite). ~8% sand (coarse grained, subrounded to subangular). Clay has medium plasticity. Moist. 1" to 1-1/2" diameter cobbles of quartzite and granite at 0.4'.
		CL: Clay with trace gravel and sand, dark brown (7.5YR3/2). ~3 - 5% gravel (1/8" - 1/2" diameter, subangular), ~3 - 5% sand. Clay has medium plasticity. Shattered quartzite cobble at 0.6'. Roots at base of interval. Moist.
		CL: Clay with trace gravel and trace sand, brown (10YR4/3) with dark yellowish brown (10YR4/6) mottling. Possibly re-worked claystone with gravel and sand. Weak iron oxidation mottled throughout and disseminated at base. Trace roots. Moist.
		No recovery.
		CL: Clay with trace gravel and trace sand, same as interval from 0.8' to 1.3'. Moist.
		GP: Gravel/Cobbles, schist and quartzite cobbles (3/4" - 2" diameter, subangular) with gravel (1/4" - 1/2" diameter, subangular, composed of amphibolite (?)). Gravel is greenish gray (GLEY5/1).
		No recovery
		GC/CL: Sandy, Gravelly Clay with silt, dark brown (7.5YR3/2) clay matrix with ~30% gravel (1/4" - 3/4" diameter, subangular, composed of quartzite and schist). 5 - 10% sand (coarse grained,

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Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
					LOG OF BORING NUMBER: 80005
	Filter Pack, 16/40 Silica Sand	5			subangular to subrounded). Clay has medium plasticity. Moist. Shattered cobbles (1" - 2" diameter) at base of interval from 4.6' to 4.8'.
5952		6			SC/CL: Silty, Sandy Clay with some gravel, brown (7.5YR4/3 to 7.5YR4/4). Sand and gravel increase at base of interval. ~35% sand from 5.1' to 5.4', sand is coarse grained, subangular. ~25% gravel (1/4" - 1/2" diameter, subangular) from 5.1' to 5.4'. Moist. Possibly fluvial in origin (?)
5951	Screen, Sch 40-PVC, 2 in. ID., 0.010 in. slots	7			No recovery.
5950		8			SC/CL: Silty, Sandy Clay with some gravel, same as interval from 4.8' to 5.4'. Moist.
5949		9			SILTSTONE: TOP OF BEDROCK. Clayey Siltstone with some fine grained sand. Bedrock is gray (10YR6/1) with abundant yellowish brown (10YR5/6) mottling. Siltstone interbedded with claystone and fine grained sandy lenses. Some caliche as stringers and blebs throughout interval. Strong pervasive iron oxidation from 8.5' to 8.7' with ironstone fragments. Moist.
5948		10			SILTSTONE: Sandy Siltstone, grayish brown (10YR5/2) with light yellowish brown (10YR6/4) iron oxidation mottled throughout. Abundant very fine grained sand in siltstone. Friable. Caliche along internal bedding at 10.7'. Decreasing moisture to slightly moist.
5947		11			
5946		12			SILTSTONE: Clayey, Sandy Siltstone, yellowish brown (10YR5/6) with gray (10YR6/1) and light brownish gray (10YR6/2) mottling. Clayey lenses at 10.9' and from 11.65' to 11.8'. Black organic stringers associated with clayey lenses. Interval is friable and slightly fissile. Rip-up clasts common. Small healed fracture (45 deg) with iron oxidation at 11.95'. Abundant very fine grained sand from 11.2' to 11.4'. Slightly moist.
5945		13			SILTSTONE: Clayey Siltstone, yellowish brown (10YR5/6) with gray (10YR5/1) mottling from 12.4' to 13.0'. Color changes to brown (10YR5/3) from 13.0' to 14.0'. Decreasing very fine grained sand to trace. Black organic stringers common from 13.0' to 14.0'. Interval is competent, yet weak to moderately friable. Rip-up clasts common. Weak to moderate iron oxidation throughout. Slightly moist.
5944		14			

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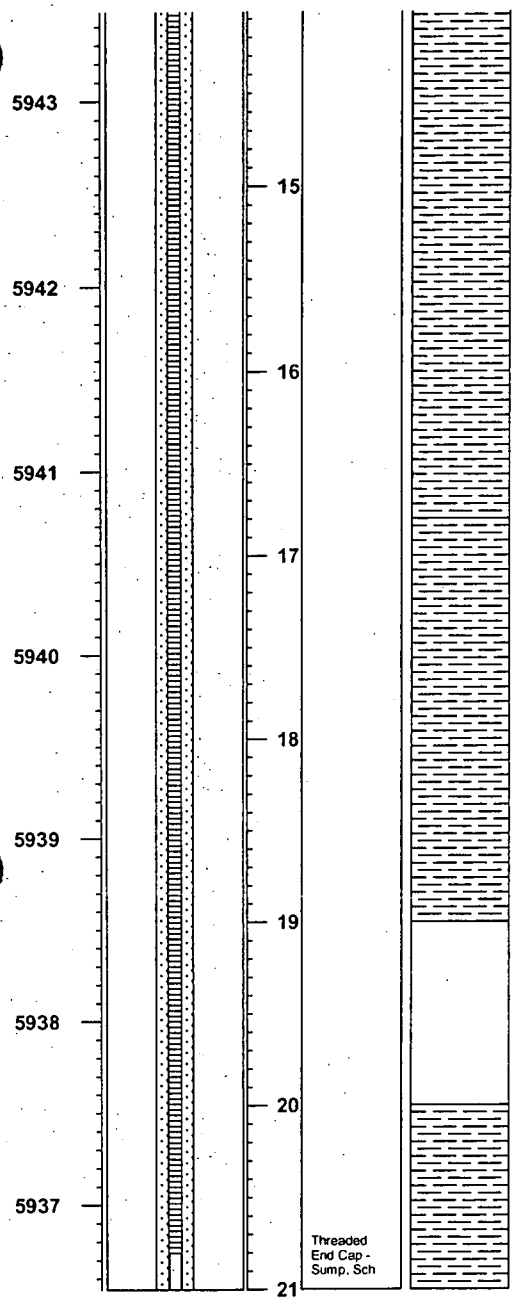
Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	LOG OF BORING NUMBER: 80005 Lithologic Description	Page 3 of 3



CLAYSTONE: Claystone with trace silt, gray (10YR5/1) with grayish brown (10YR5/2) and yellowish brown (10YR5/4) mottling. Weak to moderate pervasive iron oxidation. Some black organic stringers. Interval is firm and dense. Decreased moisture to very slightly moist.

CLAYSTONE: Claystone, un-weathered, dark gray (2.5Y4/1) to gray (2.5Y5/1). Trace iron oxidation along internal fractures from 16.8' to 17.0', and at 17.0'. Interval is highly fissile and friable. Dry.

No recovery.

CLAYSTONE: Claystone, un-weathered, dark gray (2.5Y4/1). Dense and firm, weakly fissile, dry.

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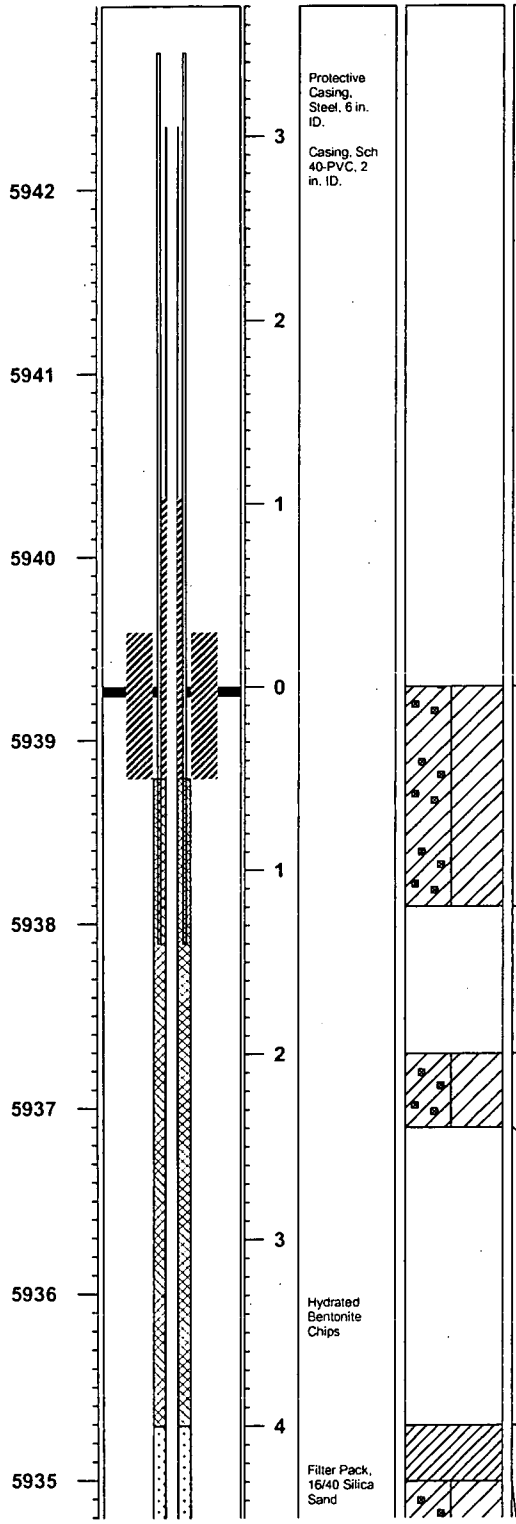
STATE PLANE COORDINATES AREA:
NORTH: 747463.414
EAST: 2081942.494
PROJECT: Original Landfill
REMARKS:
Routine well installation

GRND ELEV. (FT): 5939.29
TOTAL DEPTH (FT): 20.15
COMPLETION DATE: 8/8/05
GEOLOGIST: E. Warp

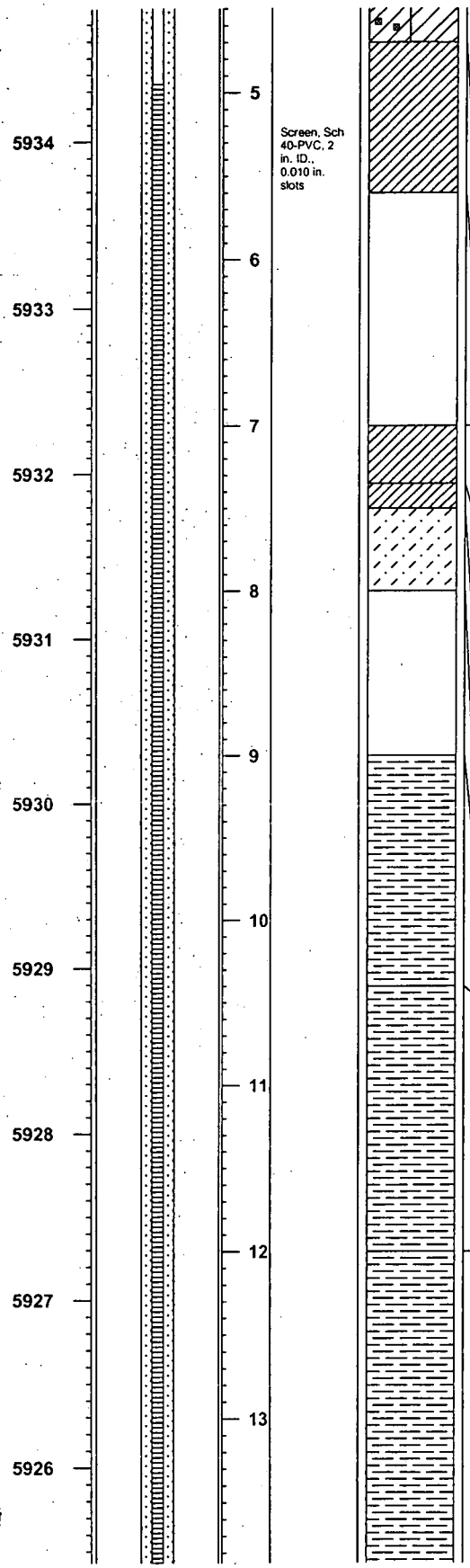
CASING DIA (IN): 2"
BH DIA. (IN): 8"
GRID LOCATOR:

LOG OF BORING NUMBER: 80105



Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
	0 – 1			GC/CL: Gravel/Sandy Clay with silt mixture. Imported Qalrf fill. Strong brown (7.5YR4/6). 20 - 25% gravel (1/8" - 1" diameter, subrounded to subangular), predominately quartzite with less schist and granite. 20% sand (coarse grained, subangular to subrounded). Clay has medium plasticity. Dark brown (7.5YR3/2) clay lense from 0.4' to 0.5'. Disseminated caliche, tiny white specks common throughout interval. Moist.
	1 – 2			No recovery.
	2 – 3			GC/CL: Gravel/Sandy Clay with silt mixture, same as interval from 0.0' to 1.2'. Moist.
	3 – 4			No recovery
Hydrated Bentonite Chips	4			
Filter Pack, 16/40 Silica Sand	4 – 5			CL: Gravelly, Sandy Clay, dark brown (7.5YR3/2). Distinct color change. ~10% sand (coarse grained, subangular), 5 - 8% gravel (1/8" - 1/2" diameter, subrounded to subangular). Trace to some

Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	LOG OF BORING NUMBER: 80105 Lithologic Description	Page 2 of 3



organic material (woodchips). Medium to high plasticity, very moist. Color change may indicate prior ground surface (before fill added).

GC/CL: Gravelly, Sandy Clay, dark gray (7.5YR4/1) to brown (7.5YR4/4). ~30% sand (coarse grained, subangular), 20 - 25% gravel (1/8" to 1-1/2" diameter, subrounded to subangular). Possible fluvial deposit. Well graded, poorly sorted, very moist.

CL: Silty Clay. Re-worked bedrock. Light gray (10YR6/2) with brownish yellow (10YR6/6) mottling. Weak iron oxidation mottling. Trace caliche. [Very poor recovery, clay has been extruded like a "ribbon" due to a clogged cutting shoe.] Very moist.

No recovery.

CL: Silty Clay. Re-worked bedrock. Light gray (10YR7/1) with some light yellowish brown (10YR6/4) iron oxidation mottling. Trace alluvial clastics indicate not yet bedrock.

CL: Clay with trace to some sand, gravel, and silt. Dark grayish brown (10YR4/2) with some light brownish gray (10YR6/2). 3 - 5% gravel (1/8" - 1/4" diameter), 3 - 5% sand (coarse grained, subangular). Weak to moderate iron oxidation mottled throughout. Very moist.

SILTSTONE: TOP OF BEDROCK. Clayey Siltstone, gray (10YR6/1) with yellowish brown (10YR6/4) iron oxidation mottled throughout. Very subtle bedrock contact. [Very poor recovery, cutting shoe is clogged causing siltstone to appear "ribboned" in sample tube.] Very moist.

No recovery.

CLAYSTONE: Claystone, gray (10YR5/1) with yellowish brown (10YR5/6) mottling. Caliche blebs and stringers common throughout. Weak iron oxidation mottling. Massive texture. Moderately friable. Notable decrease in moisture to slightly moist.

CLAYSTONE: Claystone, very dark gray (10YR3/1) to gray (10YR5/1). Massive texture. Abundant black organic stringers from 10.4' to 10.6'. Very rare caliche stringers. Moderately friable. No iron oxidation. Slightly moist.

CLAYSTONE: Claystone, grayish brown (10YR5/2). Weak pervasive iron oxidation. Trace caliche blebs. Trace black organic material. Weakly friable. Organics or trace iron oxidation along internal fractures at 12.3', 12.6', and 13.4'. Decreased moisture to very slightly moist.

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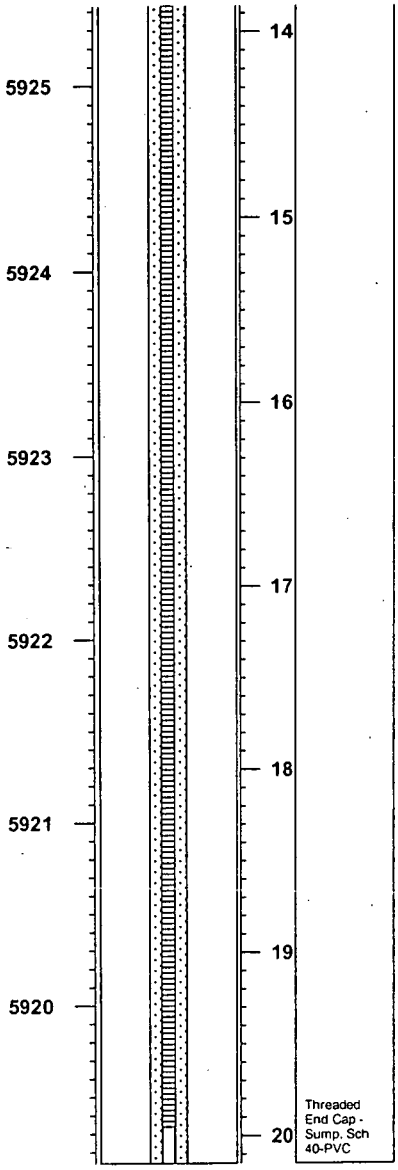
Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	LOG OF BORING NUMBER: 80105 Lithologic Description	Page 3 of 3



SILTSTONE: Clayey Siltstone, light brownish gray (10YR6/2) with some light yellowish brown (10YR6/4) iron oxidation mottling throughout. Massive texture. Weakly friable. Trace black organic stringers. Trace iron oxidation on minor internal fractures at 15.1', 15.5', 15.8', and 16.3'. Trace moisture. Occasional rip-up clasts.

No recovery.

CLAYSTONE: Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Very fissile, friable, and dry. Abundant black carbonaceous material from 18.0' to 18.5'.

No recovery. Reamed with augers from 19.0' to 20.15'. Did not sample this interval.

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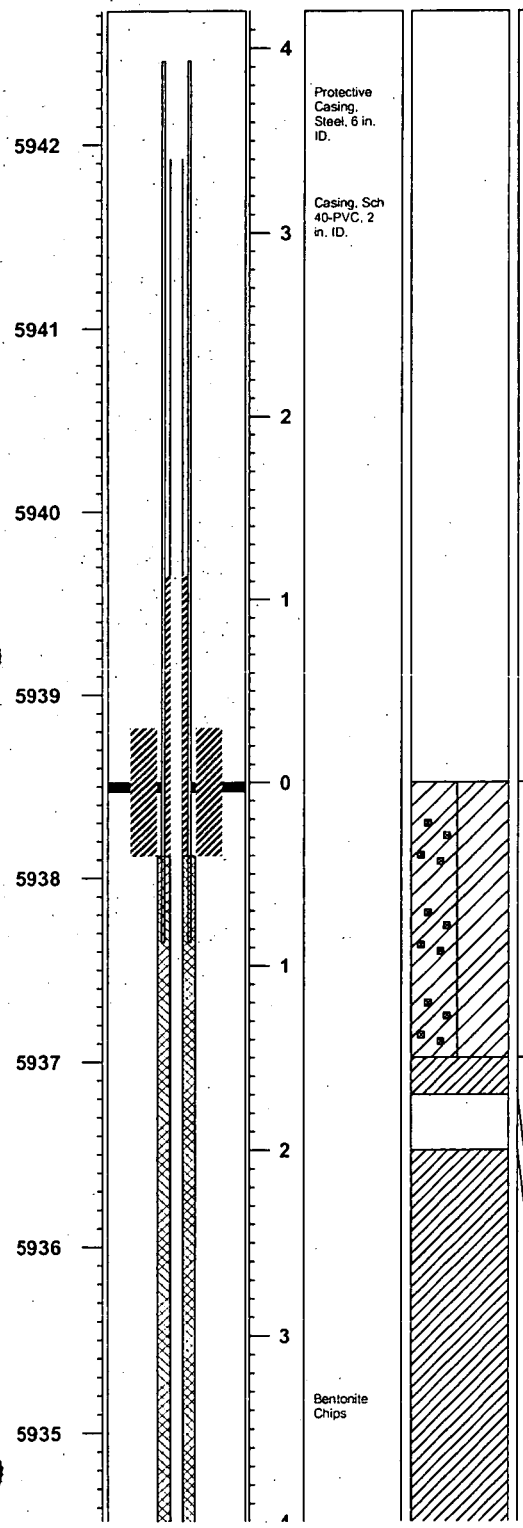
STATE PLANE COORDINATES AREA:
NORTH: 747535.636
EAST: 2082324.443
PROJECT: Original Landfill
REMARKS:
Routine well installation

GRND ELEV. (FT): 5938.52
TOTAL DEPTH (FT): 20.0
COMPLETION DATE: 8/10/05
GEOLOGIST: E. Warp

CASING DIA (IN): 2"
BH DIA. (IN): 8"
GRID LOCATOR:

LOG OF BORING NUMBER: 80205



Well or Piezometer Construction and Materials	Lithology	Unified Soils Classification or Rock Type	Lithologic Description
			GC/CL: Gravel/Sandy Clay with silt, strong brown (7.5YR4/6). 15 - 25% gravel (1/8" - 3/4" diameter, subrounded to subangular, predominately quartzite and granite). 20 - 25% sand (coarse grained, subangular). Clay has medium plasticity. Moist from 0.0' to 1.0'. Saturated, but not flowing, from 1.0' to 1.5'.
			CL: Silty Clay with trace sand and trace gravel, dark brown (7.5YR3/2) with some yellowish brown (10YR5/4) mottling. Clay has medium plasticity. Granite clast (3/4" diameter, angular) at 1.7'. Saturated, but not flowing.
			No recovery
			CL: Clay with trace silt, trace gravel, and trace sand, brown (7.5YR4/3) from 2.0' to 2.2', yellowish brown (10YR5/4) to dark yellowish brown (10YR4/4) from 2.2' to 4.0'. Appears to be re-worked claystone bedrock (?). Interval is firm and dense but pliable due to moisture. Trace black organic stringers. Trace caliche blebs at base of interval. Roots and twigs common throughout. Gravel (1/4" - 1/2", subrounded) from 3.4' to 3.6', and at base of interval. Decreased moisture to very moist.

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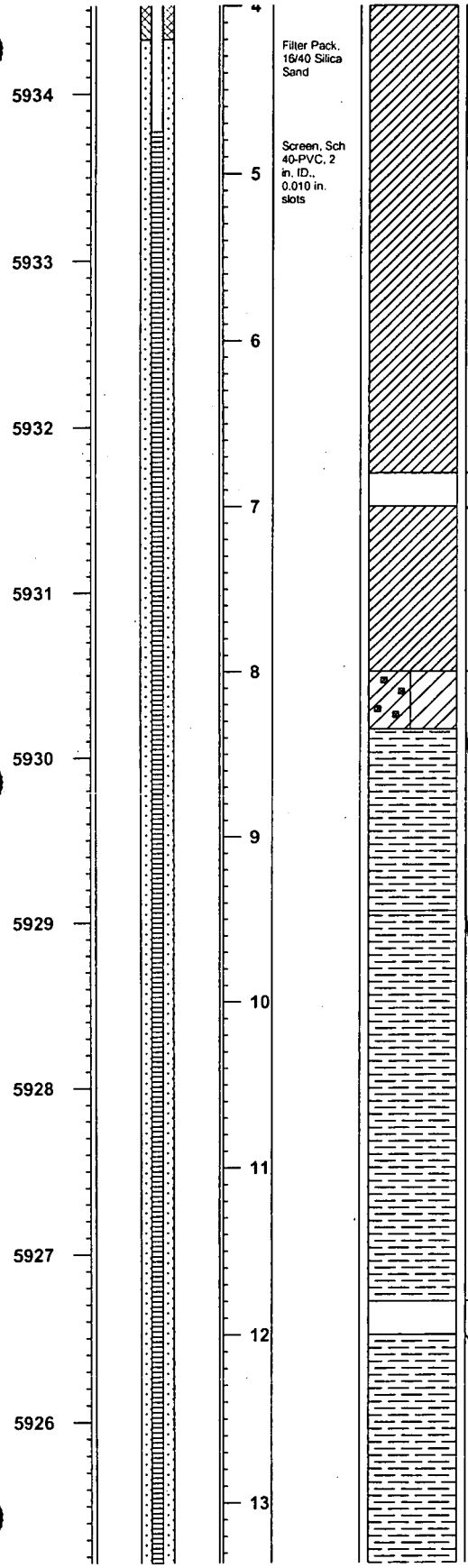
Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	LOG OF BORING NUMBER: 80205 Lithologic Description	Page 2 of 3



CL: Clay (re-worked claystone), gray (10YR5/1) with trace yellowish brown (10YR5/6) mottling. Roots common throughout interval. Trace caliche blebs. Caliche stringer with iron oxidation halo at 5.1'. Slight color change from 5.9' to 6.7' to light brownish gray (10YR6/2) with faint mottling. Decreased moisture to moist.

No recovery.

CL: Clay with trace gravel (probably re-worked claystone), grayish brown (10YR5/2). Roots common. Soft and pliable. Saturated, free water from 7.6' to 8.0'. Gravel (1/2" diameter, subrounded) at 7.6' with trace iron oxidation in clay surrounding gravel clast.

GC/CL: Gravelly Clay, dark brown (7.5YR3/3) with some strong brown (7.5YR5/6) iron oxidation at 8.15'. Strongly fractured and crumbly. 20 - 25% gravel (1/4" - 3/4" diameter, subrounded to subangular). Composition of gravel (?) - possible conglomerate, coated with iron oxide and manganese oxide. Interval is saturated with free water.

CLAYSTONE: TOP OF BEDROCK. Claystone (bedrock) - possibly re-worked. Grayish brown (10YR5/2) to gray (10YR5/1) with minor yellowish brown (10YR5/6) mottling. Roots common. Trace caliche stringers. Interval competent from 8.35' to 9.0'; friable from 9.0' to 9.45'. Distinct decrease in moisture to very moist, further decreasing to moist at base.

CLAYSTONE: Claystone, grayish brown (10YR5/2) to gray (10YR5/1) with trace brownish yellow (10YR6/8) iron oxidation mottling throughout. Massive texture. Interval is moderately friable. Slightly moist.

No recovery.

CLAYSTONE: Claystone, pale brown (10YR6/3). Massive texture. Trace iron oxidation along bedding planes. Silty lense (~1/8" thick) with iron oxidation at 13.8'. Firm and dense. Decreased moisture to very slightly moist. Trace silt at 12.5' and below.

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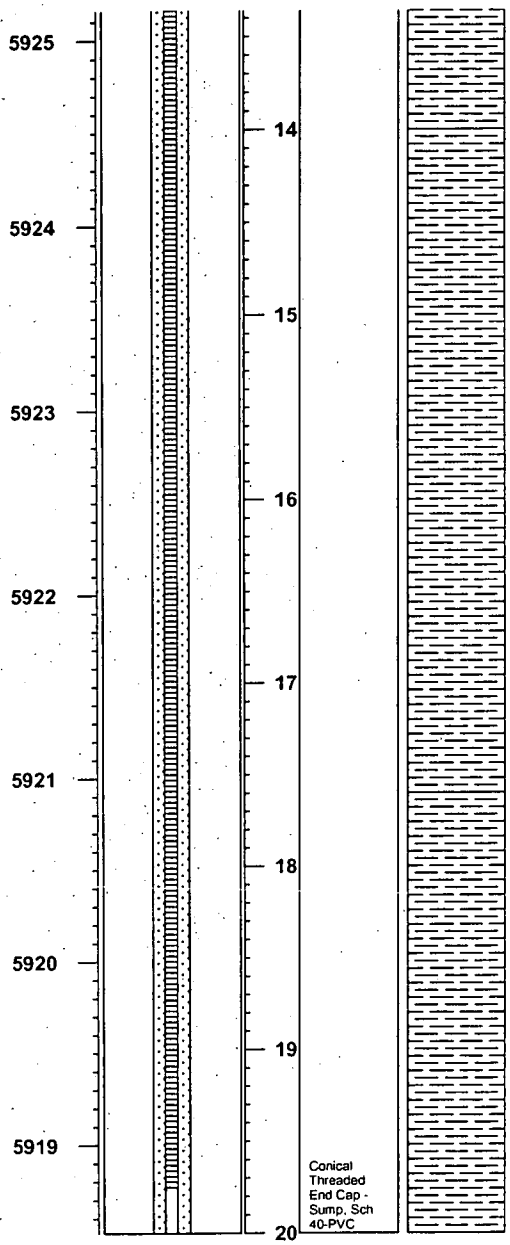
Elev (Ft)	Well or Piezometer Construction and Materials	Depth (Ft)	Lithology	Unified Soils Classification or Rock Type	LOG OF BORING NUMBER: 80205 Lithologic Description	Page 3 of 3



CLAYSTONE: Claystone, gray (10YR5/1) to dark gray (10YR4/1). Massive textured. Trace iron oxidation along bedding planes (sub-horizontal). Disseminated caliche coating from 15.2' to 15.8' along vertical fracture with iron oxidation. Interval weakly friable. Trace black organic stringers. Decreased moisture to trace.

CLAYSTONE: Claystone, dark gray (10YR4/1) to very dark gray (10YR3/1). Massive texture. Moderately fissile and friable. No iron oxidation. Trace moisture to dry.

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APPENDIX C

RFETS SOPs